VOLUME 2

Best Practices for the Assessment *and Control of Biological Hazards*

Best Practices Guidelines for Occupational Health and Safety in the Healthcare Industry

CREDITS

This document has been developed by the Government of Alberta, with input from:

- Alberta Employment and Immigration
- Alberta Health Services
- Alberta Continuing Care Safety Association
- The Health Sciences Association of Alberta (HSAA)
- United Nurses of Alberta
- Alberta Union of Provincial Employees
- Alberta Home Care and Support Association
- Alberta Health and Wellness

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Section 1

Overview

Section 1: Overview

This is the second volume in a series of five manuals that describe methods for employers and workers in the healthcare industry to improve health and safety. This volume draws from published literature (see Appendix 1) to provide information to assist with identifying, assessing and controlling biological hazards in healthcare workplaces. It can be used in conjunction with the other volumes in this series to obtain an understanding of healthcare hazards and controls, or as a "stand-alone" resource for biological hazards in healthcare.

A variety of biological hazards pose potential risks for the healthcare worker (HCW). A thorough hazard identification and assessment should be completed for all healthcare jobs. This assessment must focus on identifying potential hazards, assessing the risk and developing and implementing effective controls. In the healthcare environment, this may be complicated by an "undetermined" patient-related infectious status. It is also affected by the transmission parameters for infectious diseases, and the very nature of healthcare work, which can place HCWs close to the sources of infection. Another complicating factor is the "culture of care", which has traditionally placed patient safety and well-being above that of the worker.

In this document, best practices for controlling HCW exposure to biological hazards in the healthcare industry will be reviewed.

Example

Biological Hazards in the Healthcare Industry - examples include:

» Viruses, fungi, bacteria e.g. Influenza, Varicella, Rubella.

» Moulds.

» Blood and body fluids – Hepatitis B and C, HIV.

» Sewage.

» Anthrax – bioterrorism.

» Respiratory airborne pathogens.

This is not meant to be a definitive text on the nature of biological hazards. It is a summary of practices that have been shown to be successful in reducing the health and safety risks for HCWs.

A best practice is a program, process, strategy or activity that:

- Has been shown to be effective.
- Can be implemented, maintained, and evaluated.
- Is based on current documented information.
- Is of value to, or transferable to, other organizations.

Best practices are living documents and must be reviewed and modified on a regular basis to assess their validity, accuracy, and applicability. They may exceed, but cannot be less than, the requirements of the Occupational Health and Safety (OHS) Legislation.

All healthcare employers must consider the health and safety of HCWs as well as the health and safety of those to whom they provide services. Actions to limit disease transmission in clients is a major focal point of the work for Infection Prevention and Control (IPC) practitioners, while the health and safety of the HCW is the focus of OHS professionals. Biological hazards are most effectively controlled when everyone collaborates to limit disease transmission. In organizations having both OHS staff and IPC staff, these groups must work collaboratively to provide comprehensive risk control for both patients and HCWs.

In Alberta, the requirements for occupational health and safety are outlined in the *Occupational Health and Safety Act (OHS Act)*, Regulation (OHS Regulation), and Code (OHS Code). The *Act*, Regulation, and Code are available for viewing or downloading on the Alberta Employment and Immigration (AEI), Workplace Health and Safety (WHS) website at **www.employment.alberta.ca.** This document does not replace the *OHS Act*, Regulation, and Code and does not exempt you from your responsibilities under the legislation.

Official printed copies of the OHS Alberta *Act*, Regulation, and Code may be purchased from the Queen's Printer at **http://www.qp.gov.ab.ca/index.cfm** or:

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Main Floor, Park Plaza
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Edmonton, Alberta T5K 2P7

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Resources

How this document is organized

In this document, biological hazards and best practices for assessing and controlling them are considered from several perspectives. First, the sources of the hazards are considered. Next, there is a focus on specific hazards and mechanisms to control the hazards. Finally, a scan of the healthcare environment identifies major departments that would benefit from a control plan to address biological hazards.

How to use this document

This document is designed to be used as a resource to assist those responsible for the design and implementation of occupational health and safety programs with a specific focus on biological hazards. Sections will also be useful for HCWs and management in developing hazard assessments and determining appropriate control measures. This volume draws from published literature (see Appendix 1) to provide information about practices that are widely considered to be effective in developing and improving OHS programs with respect to biological hazards. It is intended to provide an occupational health and safety perspective on biological hazards for HCWs and to complement IPC standards and guidelines. Large healthcare organizations typically have IPC and OHS professionals whose roles include consideration of biological hazards and controls. For organizations without dedicated IPC and OHS support, Public Health Departments can provide assistance and advice on IPC issues. In addition to working with the organization OHS professionals, the following list highlights other OHS resources.

Resources

Consider these Alberta OHS Resources for obtaining more information:

- Alberta Employment and Immigration **www.employment.alberta.ca** or **http://employment.alberta.ca/SFW/6311.html.**
- Alberta Continuing Care Safety Association.
- Your Organization's Occupational Health and Safety Committee.
- Your Organization's Occupational Health and Safety Department.
- Your Organization's Infection Prevention and Control Professionals.
- Your Organization's Public Health Department.
- Your Union Occupational Health and Safety Representative.
- Your Department Occupational Health and Safety Representative.

Section 2

Roles and Responsibilities

SECTION 2: Roles and Responsibilities

The *Alberta Occupational Health and Safety Act*, Regulation, and Code combine to set out the legal requirements that employers and workers must meet to protect the health and safety of workers. These are the minimum requirements.

General Responsibilities

Employers must ensure, as far as reasonably practicable, the health and safety of all workers at their work site.

Workers must take reasonable care and co-operate with the employer to ensure the health and safety of themselves and others.

EMPLOYERS MUST:

- Assess a work site and identify existing or potential hazards.
- Prepare a written and dated hazard assessment.
- Take measures to eliminate or control identified hazards
- Involve workers in the hazard assessment.
- Make sure workers are informed of the hazards and the methods used to control the hazards.

WORKERS MUST:

- Take reasonable care to protect the health and safety of themselves and other workers.
- Cooperate with their employer to protect the health and safety of themselves and other workers.

OHS Act, Section 2, OHS Code, Part 2

Exposure to harmful substance

The OHS Code requires that exposure be kept as low as reasonably practicable/ reasonably achievable where there are harmful substances used in the workplace for which there are currently no established occupational exposure limits.

OHS Act, Section 2; OHS Code, Part 4

Definition – Harmful Substance

Legislated Requirements

"Harmful Substance" means a substance that, because of its properties, application, or presence, creates or could create a danger including a chemical or biological hazard, to the health and safety of a worker exposed to it.

OHS Code, Part 1 Definitions and General Application

Other Responsibilities

Employers must:

» Establish safe work procedures for the use and disposal of medical sharps.

» Ensure that workers are trained in safe work procedures including: information on the use and disposal of medical sharps.

» Ensure workers are informed of the health hazards associated with exposure to biohazardous material.

» Ensure that workers' exposure to biohazardous materials is kept as low as reasonably practicable/reasonably achievable.

Legislated Requirements

» Establish policies and procedures for post-exposure management of workers exposed to biohazardous material.

» Provide sharps containers and ensure that they are located as close as reasonably practicable to where sharps are used.

» Ensure that a sharps container has a clearly defined fill line and is sturdy enough to resist puncture under normal conditions of use and handling.

Workers must:

» Use the sharps container provided.

» Not recap waste needles.

OHS Act, Section 2 & Code Part 4 & 35

Legislated Requirements

Definition – Sharps

"sharps" means needles, knives, scalpels, blades, scissors and other items that can cut or puncture a person, that may also be contaminated with a biohazardous material.

Definition – Medical Sharp

"medical sharp" in Part 35 means a needle device, scalpel, lancet, or any other medical device that can reasonably be expected to penetrate the skin or other part of the body.

Definition – Safety Engineered Medical Sharp

"safety-engineered medical sharp" in Part 35 means a medical sharp that is designed to, or has a built-in safety feature or mechanism that will, eliminate or minimize the risk of accidental parenteral contact while or after the sharp is used.

OHS Code, Part 1 Definitions and General Application

Medical sharps

525.2(1) Subsections (2) and (3) come into effect on July 1, 2010.

525.2(2) An employer must provide and ensure that any medical sharp is a safety-engineered medical sharp.

525.2(3) Subsection (2) does not apply if,

(a) use of the required safety-engineered medical sharp is not clinically appropriate in the particular circumstances, or

(b) the required safety-engineered sharp is not available in commercial markets.

525.2(4) An employer must develop and implement safe work procedures for the use and disposal of medical sharps if a worker is required to use or dispose of a medical sharp.

525.2(5) An employer must ensure that a worker who is required to use and dispose of a medical sharp is trained in the safe work procedures required by subsection (4) and such training must include:

(a) the hazards associated with the use and disposal of medical sharps,

(b) the proper use and limitations of safety-engineered medical sharps,

(c) procedures to eliminate accidental contact with medical sharps, and

(d) any other relevant information.

525.2(6) A worker must use and dispose of a medical sharp in accordance with the training provided by the employer.

OHS Code, Part 35

Section 3

Best Practice Features of an Injury and Illness Prevention Program

Section 3 - Best Practice Features of an Injury and Illness Prevention Program

In the first volume of this series "Overview of Occupational Health and Safety in the Healthcare Industry", we looked at program features common to all injury prevention programs that can influence the safety culture in an organization. In this volume, all of the program features that will be discussed apply to biological hazard prevention programs. We will briefly consider some critical aspects of those features.

Management Commitment and Leadership

A clear message from senior management should indicate that all patients, residents, HCWs, volunteers, contract workers and visitors must be protected from facility-acquired infectious diseases and all biological hazards. Healthcare organizations should ensure that efforts by IPC, OHS, and Public Health staff are integrated to control the spread of infectious disease to HCWs. This may include forming a multi-disciplinary IPC Committee that includes representatives from Public Health and OHS. It also includes implementing policies and procedures to support the prevention and control plans. Education and communication are key elements for the success of the plan.

Hazard Identification and Assessment

The hazard assessment process must include the identification of existing and potential hazards for jobs and tasks at each worksite. Each identified hazard is then assessed for the level of risk that it presents. Often IPC, OHS and/or the Public Health Department contribute to the hazard assessments involving biological hazards. The frontline HCWs play a pivotal role in evaluating risk and determining appropriate precautions. For biological hazards, which do not have legislated occupational exposure limits, we adhere to legislative instruction that the employer must ensure that all reasonably practicable steps are taken to keep each HCW's exposure to that harmful substance as low as reasonably practicable. When there is no occupational exposure limit (OEL), an employer must ensure that HCWs' exposure to biohazardous materials is kept as low as reasonably practicable/achievable.

Best Practices – Hazard assessment and control and harmful substances

Direction from *Alberta Occupational Health and Safety Act*, Regulations and Code (*OHS Act*, Section 2 & OHS Code, Part 4 & 35, 2009) and best practices as set out in this document combine to guide the healthcare industry to ensure that work exposure to harmful substances are kept as low as reasonably practicable/ reasonably achievable through hazard assessment and control.

Towards an understanding of the terms "Reasonably Practicable/ Reasonably Achievable"

It makes sense...

Reasonably Practicable is a concept used by the courts to assess the "reasonable person test". This would include what a dozen peers (i.e. twelve nurses with equal qualifications and experience) consider reasonable in a similar set of circumstances. The peers would likely review what happened and compare it against what they do in their own operations. Some of them might do more, others less. The result would be a balanced and wise judgment that could be defended to others.

Reasonably Practicable is an OHS legal term that has been tested in the Canadian Courts and has supported a high standard for effective workplace protection. Understanding of the term reasonably achievable comes from the "Canadian Nuclear Safety Commission Regulatory Guide (2004)", for "Keeping Radiation Exposures and Doses As Low as Reasonably Achievable (ALARA)". Though the term reasonably achievable has not been given definite meaning by the Canadian Court system, it is generally accepted in industry to encompass the same considerations as the concept of "reasonably practicable".

Refer to **http://employment.alberta.ca/documents/WHS/WHS-LEG_ohsc_p04.pdf**

Hazard Controls

The hazard controls must incorporate the accepted hierarchy of effective controls. The most effective control is elimination of the hazard, but this is not always possible. The next control strategy is the use of engineering controls. Engineering controls reduce the possibility of exposure by controlling the hazard at its source. Examples of engineering controls include:

- » Ventilation.
- » Automated processes.
- » Isolation rooms.
- » Vaccines.
- » Safety-engineered devices and equipment.

The next level of control is administrative. Administrative controls are directed towards the HCWs, rather than directly at the hazard. Examples include:

- » Policies.
- » Procedures.
- » Health assessments appropriate to the hazard.
- » Immunization programs.
- » Training.
- » Scheduling.

Where engineering and/or administrative controls are not sufficient to eliminate or reduce the hazard, the third choice is the use of personal protective equipment (PPE). PPE is considered the "last resort" as a control, because it relies on proper use, fit and worker training. If PPE fails, there is a high likelihood of HCW exposure. Often several controls are applied simultaneously to effectively control a hazard.

Definition - Personal Protective Equipment

Means equipment or clothing worn by a person for protection from health or safety hazards associated with conditions at a work site.

OHS Code Part 1

Reporting Procedures

While Routine Practices (covered in more detail on page 39) are to be used for all patients, even before any diagnosis, the early detection of infectious disease accompanied by a review/update of hazard assessment and controls will also reduce the likelihood of disease transmission. Policies and procedures must be in place so that HCWs are able to take appropriate precautions when they know that someone has an infectious disease that is not completely controlled by Routine Practices e.g. active Tuberculosis (TB). HCWs providing direct patient care must have access to this information, while support workers will be advised of methods that are needed to protect themselves, without knowing the patient's specific health information. In healthcare, personal information is subject to legislation including the *Public Health Act*, the *Mandatory Testing and Disclosure Act*, and the *Freedom of Information and Protection of Privacy (FOIPP) Act*.

A process must be in place for HCWs to report incidents, including near miss incidents that have the potential for exposure. HCWs should be encouraged to use the standard reporting procedures. A good program includes a follow up on all incidents and a process to "report back" to HCWs about the status of the situation.

Record Keeping

Records are an important part of health and safety programs. Records of incident investigations can be analyzed for trends and used to determine interventions to address specific hazards. Records of the immune status of HCWs assist in follow-up efforts for outbreaks. Records of hazard assessments support due diligence requirements. Training and PPE fit-testing records are important in ensuring that all applicable HCWs are prepared to use the designated controls, and that legislative requirements have been met.

Communication and Collaboration

Good communication and a collaborative approach are important for an effective injury and illness prevention program. To avoid inconsistencies, OHS, IPC and Public Health should ensure communication occurs regularly. Though each group may have a different perspective, these perspectives must meet to provide clear direction for HCWs. Good communication among these parties is vital once an infectious disease has been identified. By alerting HCWs as soon as possible to known risks (when there is no violation of privacy), HCWs can take proper precautions.

Employers must:

An employer must ensure that workers are informed of the health hazards associated with exposure to the biohazardous material.

OHS Code Part 35

Program Evaluation and Continuous Quality Improvement

All programs including OHS and IPC need defined goals and objectives and a way to measure progress and outcomes. Each program should outline the scope and responsibilities for program evaluation. Regular program evaluations will assist in the detection of trends in program performance. Improvement opportunities can be identified, and the program can evolve to meet changing needs, best practices, and the organization's experience.

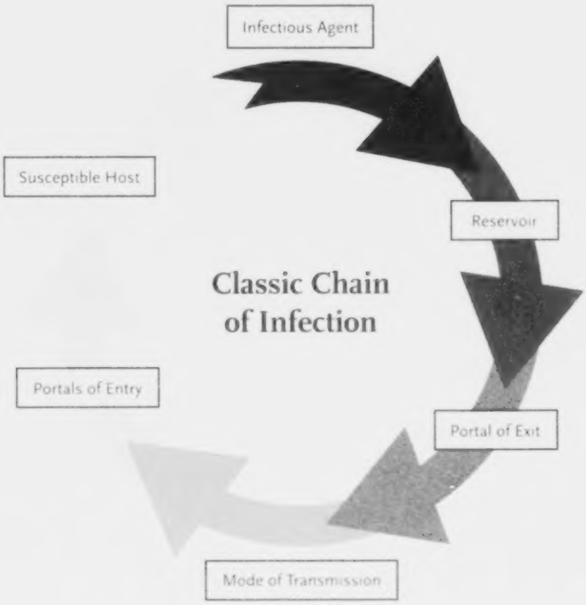
Section 4

Identification of Biological Hazards in the Workplace

Section 4 - Identification of Biological Hazards in the Workplace

As with all potential hazards in the work environment, OHS legislation requires a systematic process to identify and assess existing and potential risks of exposure to biological hazards.

"Occupational Exposure Limits" have not been established for biological agents. Best practices aim to eliminate or reduce the risk of exposure to pathogens. When conducting hazard and risk assessments the factors that are required for the transmission of infection must be considered. These factors are commonly referred to as the "chain of infection" components. Controls are directed at the chain's links to break the "chain of infection" at one of its links. The classic depiction of the chain of infection is:


Infectious Agent
Susceptible Host
Reservoir
Classic Chain of Infection
Portals of Entry
Portal of Exit
Mode of Transmission

In the above diagram, the "links" in the chain of infection are[1]:

Infectious Agent – A microorganism capable of causing disease in humans. Infectivity is affected by the organisms' viability, virulence, invasiveness and pathogenicity.

---

[1] Chain of Infection: Diagram & Explanation: Infection Control for Nursing Students: **http://faculty.ccc.edu/tr-infectioncontrol/chain.htm**

Reservoir – A source that allows for microbial growth and multiplication. Examples include people, equipment, and materials.

Portal of Exit – The means by which the organisms can leave the reservoir. Some examples include blood, skin, by coughs and sneezes, through other body substances. The portals of exit may be different for different organisms, based on where they are located in the body of the host.

Mode of Transmission – The method whereby the organisms are transmitted from one place to the next. Examples may be by direct contact, indirect contact with a contaminated body substance, vectors, and fomites (contact with inanimate objects carrying infectious disease).

Portals of Entry – The site where organisms can gain access to the hosts. Examples include mucous membranes, breaks in the skin, needle punctures, etc.

Susceptible Host – A person who lacks the immunity or resistance to the invasion of the body and reproduction by the microorganisms, resulting in infection.

When conducting hazard assessments, each task and worksite must consider the chain of infection. List tasks or environmental situations where HCWs may be exposed to biological agents and for each task identify the potential reservoirs, portals of exit and entry. Then consider the types of biological agents and modes of transmission. Once these are identified, select controls that aim to break the chain of infection at the most appropriate links. These controls should be employed to eliminate or reduce the transmission of infection to HCWs as well as to patients.

Factors Affecting Disease Transmission

Biological agents must be assessed for the level of risk that they pose to HCWs. Not all infectious diseases are occupational hazards for all HCWs, as several factors influence whether HCWs contract infectious diseases.

Biological risk assessment is complicated by the many parameters that must be considered. In **The Occupational Environment: Its Evaluation, Control, and Management**[2], the following chart was used to illustrate these parameters.

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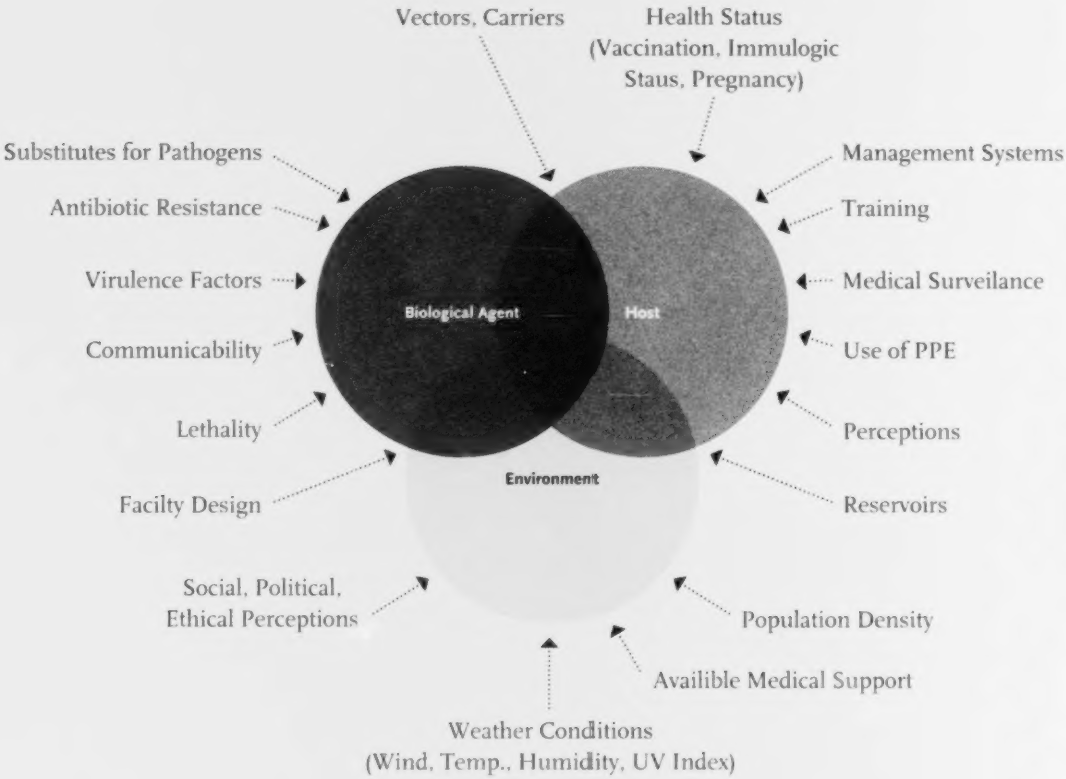
[2] **The Occupational Environment: Its Evaluation, Control, and Management 2nd Edition;** Salvatore DiNardi, Editor; AIHA Press; 2003 Chapter 19 – Biohazards in the Work Environment; Timothy Ryan; ISBN 1-931504-43-1. Used with permission of the American Industrial Hygiene Association (2009).

Risk assessment involving biological agents: factors to consider


Vectors, Carriers
Health Status (Vaccination, Immulogic Staus, Pregnancy)
Substitutes for Pathogens
Management Systems
Antibiotic Resistance
Training
Virulence Factors
Medical Surveilance
Biological Agent
Host
Communicability
Use of PPE
Lethality
Perceptions
Environment
Facilty Design
Reservoirs
Social, Political, Ethical Perceptions
Population Density
Availible Medical Support
Weather Conditions (Wind, Temp., Humidity, UV Index)

Three types of factors affect the transmission of infectious disease. These are source factors (biological agent factors), host factors and environmental factors. Source factors include the type and virulence of the biological agent, the viability of the organisms, the size of particles, and the concentration of organisms in the particles. Host factors include the health status of the person and management system aspects that reduce the potential for exposure. Environmental factors include proximity to the infectious agent, types of surfaces, facility design, environmental conditions, and ventilation factors.

Being exposed to a biological agent does not mean that an individual will always acquire the disease associated with the agent. Many factors affect the risk of becoming colonized or infected with a biological agent.

Did you know?

Legislated Requirements

Definition – "Biohazardous Material"

Means a pathogenic organism, including a bloodborne pathogen that, because of its known or reasonably believed ability to cause disease in humans, would be classified as Risk Group 2, 3 or 4 as defined by the Public Health Agency of Canada, or any material contaminated with such an organism.

OHS Code, Part 1, Definitions

"Health Canada's Laboratory Biosafety Guidelines"[3] gives more information on the risk group classifications used in the Alberta Occupational Health and Safety Code. The Guidelines classifies organisms according to risk groups 1 - 4 based on the following characteristics and provides details of precautions to be employed for each level.

- **Risk Group 1**
  Any pathogen that is unlikely to cause disease in healthy workers or animals.
- **Risk Group 2**
  Any pathogen that can cause human disease but, under normal circumstances, is unlikely to be a serious hazard to laboratory workers, the community, livestock or the environment.
- **Risk Group 3**
  Any pathogen that usually causes serious human disease or can result in serious economic consequences but does not ordinarily spread by casual contact from one individual to another, or that causes diseases treatable by antimicrobial or antiparasitic agents.
- **Risk Group 4**
  Any pathogen that usually produces very serious human disease, often untreatable, and may be readily transmitted from one individual to another, or from animal to human or vice-versa, directly or indirectly, or by casual contact.

Resources

Much more information about infectious diseases is found on the Public Health Agency of Canada's website at **http://www.phac-aspc.gc.ca/id-mi/index-eng.php**.

Specific biosafety requirements based on risk group for laboratory workers can be found in laboratory safety guideline at **www.ccac.ca/en/CCAC_Programs/Assessment/lbg_2004_e.pdf**.

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[3] This section has used the following reference extensively. *Criminal Liability of Organizations: A Plain Language Guide to Bill C-45*; Department of Justice Canada.

Section 5

Biological Hazard Assessment and Control

Section 5 - Biological Hazard Assessment and Control

Hazard assessment and control is at the foundation of occupational health and safety and is a requirement for all work sites under Alberta OHS legislation.

What is a Hazard?

> A hazard is any situation, condition, or thing that may be dangerous to the safety or health of workers.
>
> OHS Code, Part 1

What is a Biological Hazard?

Biological hazards are organisms, or substances produced by organisms, that may pose a threat to human health.

Focus

> **Sources of biological hazards include bacteria, viruses, fungi, insects, plants, birds, animals, and humans. These sources can cause a variety of health effects ranging from skin irritation and allergies to infections (e.g., tuberculosis, AIDS), cancer and so on.**
>
> Canadian Centre for Occupational Health and Safety
> **http://www.ccohs.ca/oshanswers/biol_hazards/**

Sources of Exposure to Biological Hazards

There are four major sources of biological hazards in a healthcare organization: people, equipment, environment (including building-related sources), and zoonotics. According to the "Canada Communicable Disease Report Supplement Routine Practices and Additional Precautions for Preventing the Transmission of Infection in Health Care"[4], direct contact transmission occurs when transfer of microorganisms results from direct physical contact between an infected or colonized individual and a susceptible host (body surface to body surface). Indirect contact involves passive transfer of microorganisms to a susceptible host via an intermediate object, such as contaminated hands that are not washed between patients, handling contaminated instruments, or other inanimate objects in the patient's immediate environment.

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[4] Available at **http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/99pdf/cdr25s4e.pdf**

PEOPLE

People with infectious diseases may transmit organisms to others. Sometimes the organism and illness have been identified; in other cases, these are unknown. Patients with infectious diseases may be sources of exposure to HCWs. In addition, HCWs may be exposed through contact with infected co-workers or family members of patients. Direct contact with infectious droplets and/or airborne particles from secretions expelled during sneezing, coughing or talking are the most common source of exposure to many microorganisms. This contact can be by inhalation of the droplets or airborne particles or by transmitting the organisms (usually by hand contact) to the eyes, nose, or mouth with contaminated hands or from contact with contaminated surfaces. The transmission characteristics of some organisms are well understood, while they are not completely defined for others. In some cases, people with infectious diseases have not yet been diagnosed and the nature of transmission of the disease is unknown. Where agents have not yet been identified or characterized, a highest level of control available and appropriate should be employed as a precaution.

EQUIPMENT

Inadequately disinfected medical equipment or devices may be a source for transmission of infectious agents to patients or HCWs. Examples include surgical equipment, respiratory equipment, and other devices used in direct patient care. Contaminated needles and other sharps may expose HCWs to bloodborne pathogens. Needlestick injuries present the highest risk for HCWs' exposures to bloodborne pathogens. Contaminated PPE or work surfaces that are not properly cleaned may transmit infection to HCWs. Electrocautery or laser plumes may contain bioaerosols of dead and live cellular material, including blood fragments and viruses.

ENVIRONMENT

Environmental sources of infectious disease transmission include those related to construction activities, regular building maintenance, housekeeping practices, and waste management practices. Renovation and construction processes may release fungi, viruses, bacteria and parasites that may be present in walls, wall coverings, rugs and other building materials and furnishings. Infectious organisms may also be present in ventilation and air conditioning systems.

ZOONOTICS

Zoonotic diseases are caused by viruses, bacteria, parasites and fungi that are transmitted from animals and insects to humans and can cause human disease. These are often transmitted by infectious aerosols including dusts and respiratory secretions. Zoonotic diseases may affect HCWs who are exposed to pets, rodents, insects, etc. In healthcare, affected HCWs may include building maintenance and grounds workers, community health workers, community mental health workers, first responders such as pre-hospital or emergency transfer service workers, environmental health workers, and HCWs in facilities that allow pets. Indirect exposures may also occur to other HCWs and patients by transmission of the organisms through ventilation systems or by contact with contaminated surfaces.

Exposure routes for infectious agents include:

INJECTION

» Puncture resulting in transmission to bloodstream/tissues.

» Vector borne (spread by animals or insects).

INHALATION

» Droplet (a form of direct contact with secretions of an infected person expelled a short distance during sneezing, coughing or talking).

» Airborne (air-suspended microorganisms); these can include particulates that have been resuspended after settling.

ABSORPTION; SKIN OR MUCOUS MEMBRANE CONTACT

» Indirect contact (resulting from contact with a contaminated object or surface).

» Material-borne (spread by food, water, drugs, etc. that may be infected).

» Ingestion.

» Indirect contact (resulting from contact with a contaminated object or surface).

» Material-borne (spread by food, water, drugs, etc. that may be infected).

Focus

Did you know?

Droplets are relatively large particles which, because of their size and mass, travel a short distance through air, usually no further than 2 meters. Most droplets land on inanimate objects and do not pose a respiratory hazard. Inhalable infectious airborne particles that remain aloft because of their small size and low mass do present a potential respiratory hazard to workers. These particles may be generated during coughing and sneezing, during some medical procedures, and by the aerosolization of liquids and stirring up of dusts containing biohazardous materials.

The presence of an airborne biohazardous material is not, of itself, sufficient to cause illness in an exposed worker. The pathogenicity of the material, the exposure concentration, the health status of the exposed worker and, the presence of a respiratory route of transmission need to be evaluated.

Biological hazard identification and risk assessment processes

As with all other hazards, biological hazards that may be encountered in the workplace must be identified. Risks of exposure must be considered based on the tasks that are performed and the HCWs' locations or environment. The first step in conducting a hazard assessment for a biological hazard involves describing the work involved and listing each job task with consideration to the environmental factors. This includes identification of actual or potential exposures to biological hazards in the workplace, and specifically, the risk of exposure to biological hazards in the job tasks.

Focus

How to assess and control biological hazards in the workplace

Step 1: List tasks and environment aspects.

Step 2: Identify the potential for exposure to biological agents through the various routes of entry (injection, inhalation, absorption, ingestion).

Step 3: Assess the hazard and determine the risk for exposure.

Step 4: Identify appropriate controls following the hierarchy of controls.

Step 5: Communicate the information to HCWs and provide training.

Step 6: Evaluate the effectiveness of controls and improve them as required.

Resources

For further information on Hazard Assessment and Control:

- See Volume 1 – Overview of Best Practices in Occupational Health and Safety in the Healthcare Industry: **http://employment.alberta.ca/SFW/6311.html**
- Access the Alberta Government's Hazard Assessment & Control eLearning Program at: **http://employment.alberta.ca/whs/learning/hazard/Hazard.htm**

The following checklist may be useful in evaluating your hazard identification and risk assessment processes.

Checklist

Checklist – Are biological hazards being properly identified and assessed?

☐ Do hazard assessments include consideration of biological hazards?

☐ Are the components of the "chain of infection" considered when listing biological hazards?

☐ Are the general types of biological agents that might be encountered in the worksite considered?

☐ Have previous records of exposure been used to assist in identifying potential sources of infection?

☐ Do some worksites have a higher incidence of certain types of pathogens?

☐ Is IPC consulted in determining risks related to tasks?

☐ Are frontline HCWs actively involved in the identification and risk assessment process to ensure accuracy and completeness?

☐ Are effective communications protocols used to ensure HCW awareness of outbreaks or increased potential for infection?

☐ Is there a process in place to communicate biological hazards and appropriate control measures to all staff who may be impacted?

☐ Are hazard assessments repeated periodically, whenever changes to processes are made or in the event of an epidemic?

Determination of appropriate controls

Controls chosen should reflect the hierarchy of controls, with elimination of the hazard considered first, followed by engineering controls, then administrative controls, and PPE last. Appropriate controls must be provided to HCWs, based on hazard assessment and the use of controls must be required and enforced. Where PPE is listed as a control, appropriate types and sizes must be available; appropriate fit testing, training and PPE maintenance are required.

Checklist

Are appropriate controls identified, supplied and used?

☐ Where possible, are mechanisms to eliminate the hazard at the source identified?

☐ Are engineering controls identified and implemented?

☐ Are HCWs trained on how to properly operate engineering controls?

☐ Are facilities and maintenance personnel aware of the purpose and mechanisms of ventilation as an engineering control?

☐ Are there alarms to warn of mechanical and ventilation system failures? Are HCWs trained on how to recognize alarms?

☐ Is there a preventive maintenance program for ventilation systems?

☐ Are HCWs involved in the determination and selection of hazard controls?

☐ Do IPC and OHS professionals collaborate on the selection of controls based on risk and available professional standards and best practices?

☐ Does the selection of controls take into account the chain of infection?

☐ Are all required controls available where needed?

☐ Is the use of hazard controls required and enforced?

☐ The following factors should be considered when determining the need for respiratory protective equipment:

☐ Who is potentially exposed to the biohazardous material as part of their work?

☐ What are the potential sources and routes of transmission to workers?

☐ Which job tasks increase the potential for worker exposure to biohazardous material at the workplace?

☐ Can the biohazardous material be spread to workers through airborne transmission?

The following form is a sample that can be used for the process.

Hazard Assessment and Control Sheet (Sample)

- Identify job tasks and environmental aspects of work.
- List all identified hazards.
- Identify the controls that are in place—engineering, administrative, PPE, or combination—for each hazard.

Job or Task	Potential or Existing Hazard	Hazard Risk Assessment	Controls in Place			Follow-up Action Required	Date and Person Responsible
			Engineering	Administrative	PPE		
Blood collection at bedside	*Bloodborne pathogen exposure from needlestick*	*Probability, Severity, Frequency assessment leading to assessment of risk as High, Medium or Low*	*Hepatitis B Vaccine* *Engineered safe needle devices and needless systems* *Point of use sharps containers*	*Routine Practices* *Blood collection procedures* *Training of HCWs* *Immunization program*	*Gloves* *Protective clothing*	*Increase promotion of benefits of immunization*	*Sue Brown – May 2009*

List potential or existing hazards here.

Identify controls that are in place. If you wish you may identify them by type of control.

Identify if there is any follow-up action required, such as more training or PPE.

Fill in name of person who is responsible for implementing controls.

ELIMINATING AND CONTROLLING HAZARDS

All employers are required to eliminate or control hazards. Once the hazards are identified, it is important to identify what measures (controls) can be put into place to eliminate or reduce those risks. Whenever possible, hazards should be eliminated. If elimination is not possible, they must be controlled. Control means reducing the hazard to levels that do not present a potential risk to a HCW's health. Controls must be implemented based on the hazards that are identified and the assessment of risk for existing or potential hazards. The hierarchy of controls specifies that hazards should be controlled by considering control methods in the order of elimination, engineering controls, administrative controls and lastly by the use of PPE.

First Choice	**Engineering Controls**	» vaccines » prophylactic anti-viral medications » ventilation system » engineered safe needle devices » automated equipment
Second Choice	**Administrative Controls**	» policies and procedures » Routine Practices (IPC) and other additional safe work procedures including Additional Precautions and Transmission-Based Precautions » immunization programs » training » quarantine and isolation procedures
Third Choice	**Personal Protective Equipment (PPE)**	» gloves » protective clothing » eye protection » face protection » respiratory protective equipment (RPE)
May be required	**Combination of above**	» engineering » administrative » PPE

For all types of hazards, the hierarchy of controls must be respected. To implement effective controls for biological hazards, consider how the organism is spread. In the case of biological hazards, eliminating the hazard at the source is not always an option, as the patient-as-source cannot be avoided. However, Routine Practices and Additional Precautions (where required) greatly assist in reducing the transmission of infectious agents from both known and unknown patient sources by treating all contacts as potential risks.

Infection Prevention and Control Definitions:

- **Colonization** occurs when bacteria are present on or in the body without causing illness.
- **Infection** is the entry and multiplication of an infectious agent in the tissues of the host.
  - Inapparent (asymptomatic, sub-clinical) infection; an infectious process running a course similar to that of clinical disease but below the threshold of clinical symptoms.
  - Apparent (symptomatic, clinical) infection; on resulting in clinical signs and symptoms (disease).
- **Routine Practices** include a recommended pattern of behaviors to form the foundation of limiting the transmission of microorganisms in all health care settings and is generally accepted care for all clients. Elements of Routine Practices are: hand hygiene; risk assessment related to client symptoms, care and service delivery, including screening for infectious diseases; risk reduction strategies through the use of PPE, cleaning environment, laundry, disinfection and sterilization of equipment, waste management, safe sharps handling, client placement and healthy workplace practices; and education of healthcare providers, clients and families, and visitors.
- **Additional precautions** are practices used to prevent transmission of infectious agents that are spread by direct or indirect contact with the client or client's environment that are necessary in addition to Routine Practices for certain pathogens or clinical presentations. These precautions include Contact Precautions, Droplet Precautions, and Airborne Precautions that are based on the method of transmission.

For more information: **http://www.health.alberta.ca/documents/IPC-MRSA-Standards-2008.pdf.**

Did you know?

Routine Practices include being attentive to all routes of transmission and assumes all blood and body fluids except sweat are potentially infectious. Awareness of routes of transmission has led to the development of a variety of transmission-route specific strategies. Most of these are well documented in infection prevention and control plans. In particular, hand hygiene is identified as the single most important administrative strategy in infection prevention and control. Other strategies include additional precautions designed to address infections transmitted through the "airborne" route, those transmitted through "droplets" and those transmitted through "contact". It should be noted that though some infection prevention and control plans appear to provide sharp demarcations as to what size of particle is transmitted by which route (particularly by airborne and droplet); it is highly likely that there is a continuum of particle sizes produced at any time and the determination of transmission route is more a probability than a certainty. For this reason, one must be careful in defining OHS control strategies based solely on particle sizes.

Focus

> In some circumstances, identification of the specific organism responsible for the infection may take considerable time, during which patient care is required. In these cases, it is prudent to apply the most stringent precautions until evidence indicates that less are required. In cases where the transmission route or organism has not yet been identified, it is prudent to assume all routes of transmission may be possible, as this would drive the highest level of precautions available and appropriate. Once more information is known about the organism, precautions can be revised to take that knowledge into account.

In the hierarchy of controls, the highest level of control is directed at the source. Typically, for patient related infectious disease, this means isolation of the patient and precautions related to handling blood and body fluids of the patient, as well as biological waste handling procedures. From an occupational health perspective, the highest level of control may be immunization of HCWs who may come in direct contact with infected patients. Good engineering controls such as vaccines, proper ventilation, needleless systems, safety engineered sharps, biological safety cabinets, and effective biological waste containment also contribute to minimizing the transmission of infectious agents. Engineering controls, once designed and implemented, are not under the control of the worker, but are directed at the source of the hazard.

The next level of controls includes administrative controls. Because it is not always possible to eliminate or control the hazard at the source, administrative controls are frequently used for biological hazards in healthcare. Administrative controls focus on ensuring that the appropriate prevention steps are taken, that all proper work procedures are documented, that HCWs are trained to use the proper procedures, and that their use is enforced. Administrative controls include policies and procedures that establish expectations of performance, codes of practice, staff placement, required orientation and training, work schedules, and occupational health programs in which baseline immune status is recorded and immunizations are provided. Procedural controls may include hands-free or no touch techniques for passing instruments in the Operating Room, Routine Practices, procedures that relate to detection and follow-up of infectious diseases, baseline health assessments and periodic screening of HCWs, hazard identification and control processes, and outbreak management procedures. All work procedures should include the consideration and control of the risk of exposure to HCWs.

Did you know?

Administrative controls are considered somewhat less effective than engineering controls, as they require employees to actively engage the controls and managers to enforce them.

The third level of control in the control hierarchy is PPE. In the healthcare environment, PPE is often used in addition to other controls to further minimize the risk of exposure to infectious agents.

Did you know?

PPE provides a barrier between the HCW and the hazard. PPE is considered third for two major reasons – first, it totally relies on the HCWs' knowledge of and compliance with proper selection and use of the equipment. Second, should the equipment fail, it is highly likely the HCW would be exposed to the hazardous agent. PPE commonly used in healthcare settings includes gloves, respirators, gowns, eye protection, shoe covers, and other protective clothing. Effective use of PPE requires that HCWs be trained in the selection, use, and limitations of PPE and in some case (respirators) be properly fit tested for their use.

Often combinations of controls that include all levels in the hierarchy of controls are employed to protect the HCW.

Legislated Requirements

> In Alberta, the OHS Code directs the use of the hierarchy of controls. The employer may use a combination of engineering controls, administrative controls or personal protective equipment that results in a greater level of worker safety than if each was used on its own
>
> OHS Code, Part 2

Of key importance is understanding the hazard, assessing its risk, and choosing and implementing effective controls. Higher risk hazards take precedence when developing controls, and in many cases, multiple controls are required to provide adequate protection.

Engineering Controls

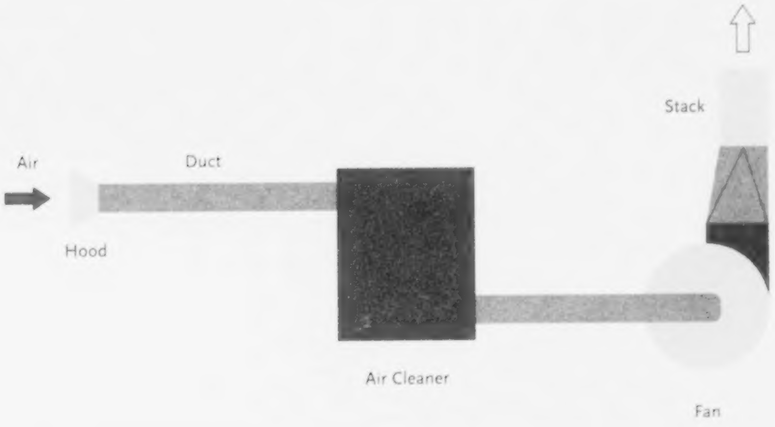
Engineering controls are considered the most desirable form of control. The highest level of control is the elimination of the hazard altogether – something not often possible when dealing with infectious patients. Many mechanisms are available for controlling the hazard at the source and along the path of transmission.

For biological hazards, common engineering controls include:

- » Local exhaust ventilation.
- » General ventilation.
- » Isolation.
- » Negative pressure rooms.
- » Engineered safe needle devices.
- » Decontamination facilities and materials.
- » Facility design.

LOCAL EXHAUST VENTILATION

Local exhaust ventilation removes contaminants at the source where the contaminant originates and can be very effective at controlling HCW exposure. The components of a local exhaust system include a hood into which contaminated air flows, ducting for air to pass through, a fan to move the air, and an exhaust. For biological hazards, local exhaust ventilation is used in laboratories or in some instruments that create aerosols. The following figure[5] outlines the major components of a basic local exhaust ventilation system.



Examples of local exhaust ventilation include biological safety cabinets (BSCs) and capture devices on autopsy saws or some surgical equipment, such as laser implements where a plume containing infectious material can be generated. Filtration media may be incorporated into local exhaust systems to remove contaminants from air that is discharged outdoors or in some cases back into the indoor environment. The filter most often used with local exhaust ventilation for biological hazards is the High Efficiency Particulate Air filter (HEPA), which is designed to filter out small microorganisms. Local exhaust systems require regular inspection by competent individuals to ensure that they continue to operate as designed. Some systems may also require preventative maintenance, including changing filtration media if the system is equipped with air cleaning devices. These filtration media must be changed periodically and are considered to be biohazardous, requiring disposal as biohazardous waste.

A biological safety cabinet should be selected by careful consideration of the class of biohazardous agent that is present, as well as the need to use toxic or volatile chemicals with the samples. Class II cabinets are the most common type used in biomedical laboratories as they provide both HCW and sample protection from contamination. Several types of Class II cabinets are available. These types vary as to percentage of air recirculated to the cabinet, as well as the type of exhaust (hard-ducted to the exterior or exhausted into the laboratory air). The following diagram[6] depicts how the ventilation works in a BSC Class II cabinet (Type B2):

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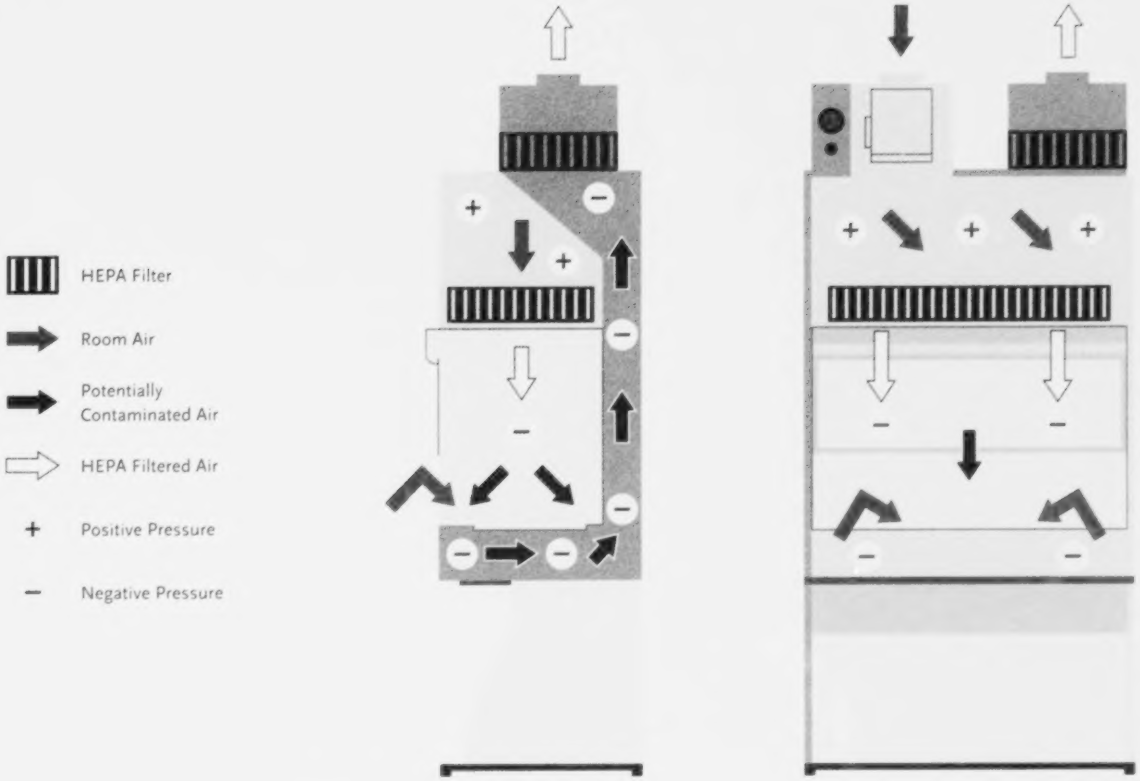
[5] From CCOHS Publication OSH Answers – *Industrial Ventilation*; found at **http://www.ccohs.ca/oshanswers/prevention/ventilation/**. Used with permission.

[6] Taken for Health Canada's *Laboratory Biosafety Guidelines 3rd Edition*, 2004 Used through courtesy of the Public Health Agency of Canada.


HEPA Filter
Room Air
Potentially Contaminated Air
HEPA Filtered Air
+ Positive Pressure
− Negative Pressure
+
−

Section View

Front View

Proper use of BSCs is essential for the devices to function as they are designed. For laboratory workers and others who use BSCs, the following checklist[7] may be useful:

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[7] Reproduced from *the Journal of Medical Laboratory Science*, "Spotlight on Safety - Back to the Basics – Safe Operating Procedures for Chemical Fume Hoods and Biological Safety Cabinets"; 2004.

Biological Safety Cabinets (BSC)

Yes	No	
		1. Do you know the class of BSC you are using?
		2. Do you know the principles of airflow patterns in the types of BSC you are using?
		3. Is the class of BSC you are using appropriate for the organisms you may encounter?
		4. Do you turn on the BSC at least 5 minutes before use to ensure that the standing air is removed and clean air is introduced? (BSCs can be kept on 24 hours a day.)
		5. Do you minimize the quantity of items in the BSC, as this will ensure proper efficiency of the BSC?
		6. Do you always ensure that the grills are free of obstructions?
		7. Do you eliminate the use of regular Bunsen burners and other equipment that may create air turbulence in the BSC?
		8. Do you organize your work in the BSC to segregate clean and contaminated items, and avoid passing contaminated items over clean ones (as the current of air is provided in a downward direction)?
		9. When you have completed your work in the BSC, do you let the BSC fan operate at least 5 minutes to ensure that any contaminated air remaining in the cabinet is drawn through the filter?
		10. Do you perform appropriate disinfection/decontamination procedures before you start and after you finish work in the BSC?
		11. Do you ensure that your work is conducted in the clean zone of the BSC?
		12. Do you use horizontal pipette discard trays containing the appropriate disinfectant within the cabinet to avoid air disruption and contamination?
		13. Do you ensure that any potentially contaminated items are surface decontaminated before they are brought out of the BSC?
		14. Do you keep clean materials at least one foot away from aerosol-creating activities in the BSC?
		15. Do you ensure that bottles or tubes are held at an angle, and that petri dishes/culture plates are held with the lids above the sterile surfaces to avoid the direct impact of downward air?
		16. Do you use a loop incinerator or disposable loops to avoid having a Bunsen burner in the BSC?
		17. Do you ensure that contaminated liquids are handled appropriately?
		18. Do you avoid the use of chemicals in the BSC?
		19. Is your BSC located away from doors, windows, air diffusers, or traffic?
		20. Do you ensure that the BSC is tested upon installation, annually or when moved?
		21. Do you follow the maintenance instructions provided by the manufacturer?

BSCs must be certified for use when they are first installed, if they are ever moved, and annually.

GENERAL VENTILATION

General ventilation refers to ventilation that is provided in a facility primarily for occupant comfort and to exchange air within work space with "fresh" air that includes some outdoor air. General ventilation acts to reduce concentrations of contaminants in the indoor air by dilution, by mixing with a supply of uncontaminated air. For these reasons, and others, general ventilation is not used for control of air contaminants that pose a serious health risk, or where large amounts of contaminants are generated. General ventilation systems serving buildings must be maintained regularly and inspected for conditions that could adversely affect air quality provided to work spaces. Accumulations of water that could stagnate in humidification systems or drip trays are sources of potential biological contamination of air handling systems that need regular monitoring and inspection. Some types of filtration media in air handling systems serving some portions of healthcare organizations may pose biological risk to HCWs when they are changed, requiring the use of PPE including respiratory protection, gloves, and eye protection.

Biohazardous organisms may be carried through general ventilation systems, potentially distributing them to other workspaces in a facility. Ultraviolet germicidal irradiation units, and or HEPA filtration media incorporated into air handling systems may be considered for special circumstances.

Mould growth in the indoor environment can be affected by relative humidity levels, which is a function of some general ventilation systems. High relative humidity levels may contribute to an increase in the growth of some moulds and lead to condensation developing on surfaces. Control of indoor relative humidity levels is an important factor in preventing mould growth. Ventilation systems should maintain relative humidity levels below 60% for most areas and wet areas such as tub rooms, bathrooms, or dishwashing areas should be ventilated appropriately to control humidity levels.

More information can be found in the Government of Alberta's

Indoor Air Quality Tool kit, available at:
http://employment.alberta.ca/documents/WHS/WHS-PUB_gh015.pdf.

Best Practice – Mould at the Worksite, available at:
http://employment.alberta.ca/documents/WHS/WHS-PUB_bh019.pdf.

Resources

ISOLATION

In many health care facilities, patients with known or suspected infectious diseases are physically isolated from other patients to prevent transmission of infectious organisms. Isolation rooms must be specifically designed and constructed to protect the unique needs of patients who are placed in isolation as well as for HCW protection. Depending on the nature of biological agents, the requirements for isolation rooms will vary in their physical design, furnishings, air handling systems and air pressurization of the room relative to adjacent areas.

When isolating patients on droplet or contact isolation, room fittings and furnishings in isolation rooms should be constructed of smooth, nonporous surfaces that can be scrubbed, rather than textured material such as upholstery or carpeting. A hand washing sink to perform hand hygiene should also be present and ideally, the room door should be self-closing and a dedicated washroom located at the entry/exit point.

NEGATIVE PRESSURE ROOMS

In addition to the requirements for isolation rooms used for droplet or contact isolation, negative pressure rooms may be required for patients with pathogens transmitted by the airborne route. These rooms should be well sealed to prevent the air from escaping into other areas. Anterooms should be incorporated as determined by assessment of risk.

When isolating patients on airborne isolation, the design, operation and maintenance of air handling systems serving the room are critically important.

General ventilation characteristics of negative pressure isolation rooms for airborne isolation are outlined by the Centers for Disease Control and Prevention in their document "Guidelines for Preventing the Transmission of Mycobacterium Tuberculosis in Health-Care Settings"[8] they are:

1. A negative pressure of 2.5 Pascals is recommended.
2. Monitor the negative pressure in the room, by methods such as flutter strips, smoke tubes or instrumentation at the room entrance that displays the room's negative pressurization and alerts of ventilation system failure.
3. Maintain 12 air changes per hour for the room.
4. A minimum of 2 air changes per hour of outside air should be provided to the room.
5. Keep room doors and windows closed.
6. Doors to the room should be self closing.
7. Exhaust room air directly outside the facility; the use of HEPA filters on exhausted air may be required.

Resources

Additional Resources:

For more information related to design considerations for health care facilities, refer to the Alberta Infrastructure document - Technical Design Requirements for Health Care Facilities published as "The Blue Book" and available at **http://www.infrastructure.alberta.ca/Content/docType486/Production/BlueBook-2005.pdf**

ENGINEERED SAFE NEEDLE DEVICES

In NIOSH's publication "Alert Preventing Needlestick Injuries in Healthcare Settings", 1999, a study analyzed nearly 5,000 percutaneous injuries experienced by HCWs. The following figure[9] depicts the types of hollow bore needles or other sharps that resulted in percutaneous injuries.

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[8] Centers for Disease Control and Prevention: *Guidelines for Preventing the Transmission of Mycobacterium tuberculosis in Health-Care Settings*. MMWR 2005;54(No. RR-17), 2005.

[9] NIOSH Alert *Preventing Needlestick Injuries in Healthcare Settings*, November 1999.

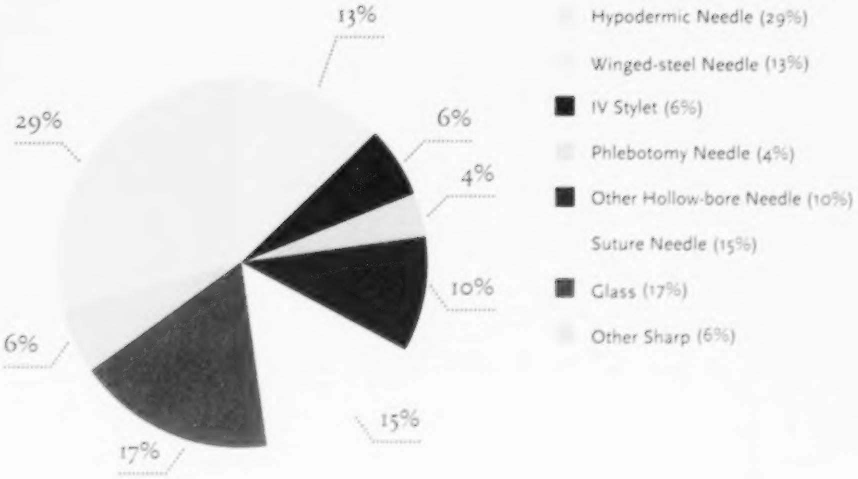

Figure 1. Hollow-bore needles and other devices associated with percutaneous injuries in NaSH hospitals, by % total percutaneous injuries (n=4,951). June 1996 – July 1999. (Source: CDC [1999].)

The study also considered the causes of the percutaneous injuries which are detailed in the following figure[10]

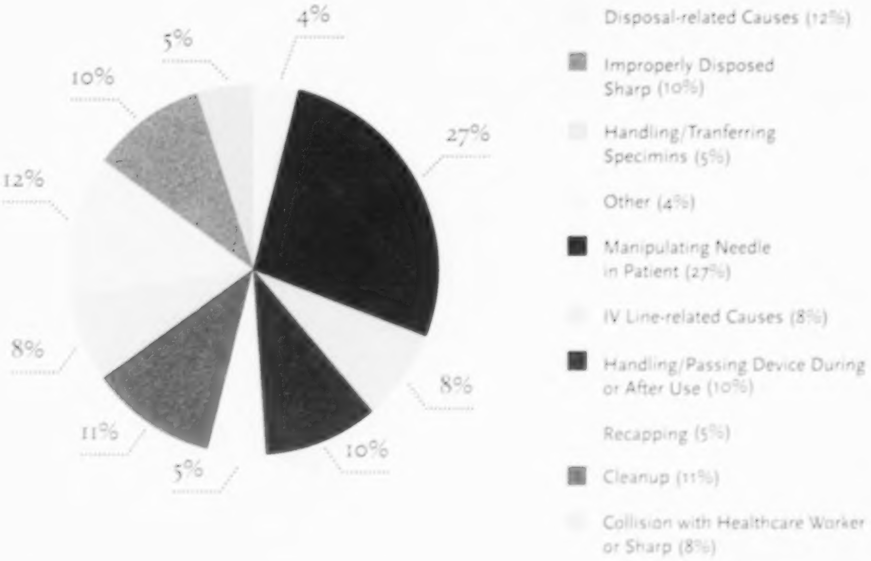

Figure 2. Causes of percutaneous injuries with hollow-bore needles in NaSH hospitals, by % total percutaneous injuries (n=3,057). June 1995 – July 1999. (Source: CDC [1999].)

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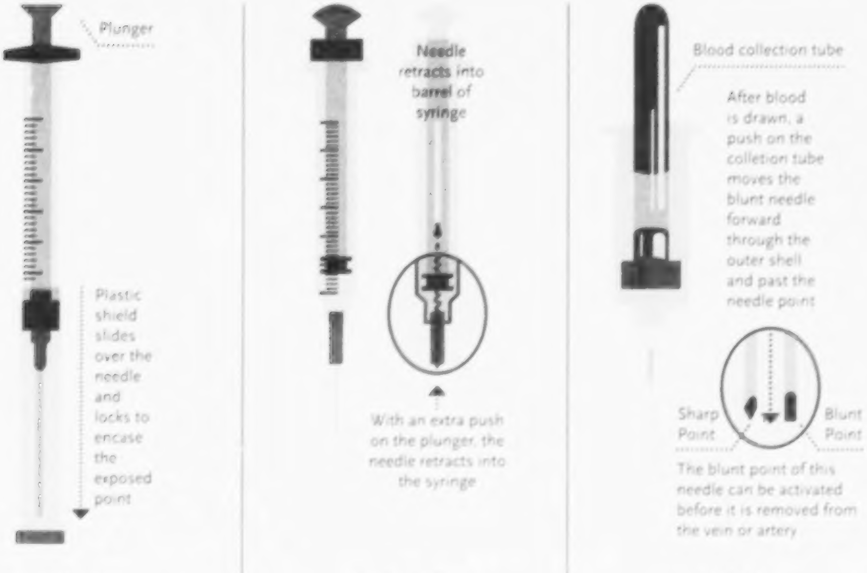
[10] NIOSH *Alert Preventing Needlestick Injuries in Healthcare Settings*. November 1999.

Safe needle devices have built-in engineering features that assist in preventing injuries during and after use of the device. Some examples of syringes with safety features are presented in the following figure[11].


Plunger
Plastic shield slides over the needle and locks to encase the exposed point
Needle retracts into barrel of syringe
With an extra push on the plunger, the needle retracts into the syringe
Blood collection tube
After blood is drawn, a push on the colletion tube moves the blunt needle forward through the outer shell and past the needle point
Sharp Point
Blunt Point
The blunt point of this needle can be activated before it is removed from the vein or artery

Syringe with protective shield

Syringe with retractable needle

Blunt-tip blood-drawing needle

Figure 3. Three Examples of syringes with safety features. (These drawings are presented for educational purposes and do not imply endorsement of a particular product by NIOSH.)

Other examples of safe needle devices that have built-in engineering features include:

» Needleless connectors for IV delivery systems.

» Protected needle IV connectors.

» Needles that retract into a syringe or vacuum tube holder.

» Hinged or sliding shields attached to syringes.

» Self-blunting phlebotomy and winged steel needles.

» Blunt tip suture needles.

» Retractable finger/heel-stick lancets.

While some engineered safe needle devices have been available for some time, new engineered safe needle devices continue to be introduced for the healthcare industry.

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[11] NIOSH *Alert Preventing Needlestick Injuries in Healthcare Settings*, November 1999.

NIOSH has outlined the following desirable characteristics for consideration when selecting engineered safe needle devices.

1. The device is needleless.
2. The safety feature is an integral part of the device.
3. The device preferably works passively (i.e., it requires no activation by the user). If user activation is necessary, the safety feature can be engaged with a single-handed technique and allows the HCW's hands to remain behind the exposed sharp.
4. The user can easily tell whether the safety feature is activated.
5. The safety feature cannot be deactivated and remains protective through disposal.
6. The device performs reliably.
7. The device is easy to use and practical.
8. The device is safe and effective for patient care.

Focus

As many types and styles of safe needle devices are now available, each device that is being considered for use must be evaluated to ensure that it is acceptable to the HCWs who will use or handle the device, that the safety features work effectively and reliably and the device does not adversely affect patient care or pose increased risks to staff. HCW involvement in the trial and selection of engineered safe needle devices is important, as this ensures the devices selected are practical and appropriate in work settings.

Sharps disposal containers assist in protecting HCWs from injuries when handling and transporting waste sharps. The CSA standard "Z316.6-07 Evaluation of Single-use and Reusable Medical Sharps Containers for Biohazardous and Cytotoxic Waste" should be consulted when selecting sharps containers. NIOSH reported in its publication Selecting, "Evaluating and Using Sharps Disposal Containers"[12], January 1998, that many of the reported sharps injuries have been reported to be related to the disposal process. The factors most often related to sharps injuries in the disposal process include the following:

- Inadequate design or inappropriate placement of the sharps disposal container.
- Overfilling of sharps disposal containers.
- Inappropriate sharps disposal practices by the user during patient care.

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[12] NIOSH: *Selecting, Evaluating and Using Sharps Disposal Containers*, January 1998. **http://www.cdc.gov/NIOSH/sharps1.html**

Sharps disposal containers are available in a wide variety of styles, sizes, shapes and intended usage. Proper selection of sharps disposal containers is vital as a single style of container will not meet the disposal needs for all types of sharps, or the circumstances for which the container will be used. For example, special sharps containers may be required for use when additional hazards are present (radioactive materials, etc.).

Focus

To be effective at preventing sharps injuries, NIOSH has identified four major criteria for evaluating the performance of sharps disposal containers. These include[13]:

» **Functionality:** Containers should remain functional during their entire usage (i.e., they should be durable, closable, leak resistant on their sides and bottom, and puncture resistant until final disposal).

» **Accessibility:** Containers should be accessible to HCWs who use, maintain, or dispose of sharp devices. Convenient placement should also be considered, along with portability of containers within the workplace, if necessary.

» **Visibility:** The following should be plainly visible to the HCWs who use the containers: the container, the degree to which it is full, the proper warning labels, and the color-coding of the container.

» **Accommodation:** Containers should be accommodating or convenient for the user and the facility and should be environmentally sound (e.g., free of heavy metals and composed of recycled materials). Accommodation also means ease of storage, assembly and operation.

The Training for Development of Innovative Control Technologies (TDICT) Project has developed a form[14] for evaluation of sharps collection devices. This form may be beneficial for evaluating sharps collection containers that are being trialed in a facility or in developing a customized evaluation tool.

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[13] NIOSH: *Selecting, Evaluating and Using Sharps Disposal Containers*, January 1998. **http://www.cdc.gov/NIOSH/sharps1.html**

[14] Training for Development of Innovative Control Technology Project, **http://www.tdict.org** reprinted with permission

Safety Feature Evaluation Form

SHARPS DISPOSAL CONTAINERS

Date:	**Department:**	**Occupation:**
Product:	**Number of times used:**	

	agree...................................disagree					
1. The container's shape, its markings, or its color, imply danger.	1	2	3	4	5	N/A
2. The implied warning of danger can be seen from the angle at which people commonly view it. (very short people, people in wheel chairs, children, etc.).	1	2	3	4	5	N/A
3. The implied warning can be universally understood by visitors, children, and patients.	1	2	3	4	5	N/A
4. The containers purpose is self-explanatory and easily understood by a worker who may be pressed for time or unfamiliar with the hospital setting.	1	2	3	4	5	N/A
5. The container can accept sharps from any direction desired.	1	2	3	4	5	N/A
6. The container can accept all sizes and shapes of sharps.	1	2	3	4	5	N/A
7. The container allows single handed operation. (Only the hand holding the sharp should be near the container opening).	1	2	3	4	5	N/A
8. It is difficult to reach in and remove a sharp.	1	2	3	4	5	N/A
9. Sharps can go into the container without getting caught on the opening.	1	2	3	4	5	N/A
10. Sharps can go into the container without getting caught on any molded shapes in the interior.	1	2	3	4	5	N/A
11. The container is puncture resistant.	1	2	3	4	5	N/A
12. When the container is dropped or turned upside down (even before it is permanently closed) sharps stay inside.	1	2	3	4	5	N/A
13. The user can determine easily, from various viewing angles, when the container is full.	1	2	3	4	5	N/A
14. When the container is to be used free-standing (no mounting bracket), it is stable an unlikely to tip over.	1	2	3	4	5	N/A
15. It is safe to close the container. (Sharps should not protrude into the path of hands attempting to close the container).	1	2	3	4	5	N/A
16. The container close securely. (e.g. if the closure requires glue, it may not work if the surfaces are solid or wet).	1	2	3	4	5	N/A
17. The product has handles which allow you to safely transport a full container.	1	2	3	4	5	N/A
18. The product does not require extensive training to operate correctly.	1	2	3	4	5	N/A

Of the above questions, which three are the most important to **your** safety when using this product?

Are there other questions which you feel should be asked regarding the safety/utility of this product?

DECONTAMINATION[15] FACILITIES AND MATERIALS

Decontamination is a term used to describe procedures that remove contamination by killing microorganisms, rendering the items safe for disposal or use. Sterilization refers to the complete destruction or removal of all microorganisms by chemical or physical means, usually to provide sterile items for use. All contaminated materials must be decontaminated before disposal or cleaning for reuse. The choice of method is determined by the nature of the material to be treated.

Worker Decontamination

As it relates to biohazardous materials, it is recommended that employers develop and implement procedures that describe methods to clean, disinfect, or dispose of contaminated articles or clothing.

OHS Code, Part 4

Focus

Disinfection refers to the destruction of specific types of organisms but not all spores, usually by chemical means. Disinfection is a means of decontamination.

Resources

For specific guidance on decontaminating reusable medical devices, consult the Alberta Government's Standards for Cleaning, Disinfection and Sterilization of Reusable Medical Devices for all Health Care Facilities and Settings. Available at: **http://www.health.alberta.ca/documents/IPC-Medical-Device-Cleaning-2008.pdf**

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[15] This section was modified from Laboratory Safety: CSMLS Guidelines, sixth edition; Gene Shematek & Wayne Wood; Canadian Society for Medical Laboratory Science; 2006.

The three principal methods of decontamination in general use are:

- Autoclave.
- Chemical disinfectants.
- Incineration.

Methods used for decontaminating re-usable equipment are:

- Autoclave.
- Chemical disinfectants.

Sterilization is used for equipment or materials that are to be re-used for invasive procedures. Most frequently, sterilization is accomplished by:

- Steam autoclaves.
- Gas sterilizers (ethylene oxide).
- Dry heat.

Surfaces must be decontaminated after any spill of potentially infectious materials and at the end of the working day. Work areas, patient rooms, and pieces of equipment may also require decontamination (i.e., prior to servicing, maintenance, between patients, transfer to other settings or reassignment).

Specific written protocols must be developed and followed for each decontamination process. HCWs must be trained in all decontamination procedures specific to their activities and should know the factors influencing the effectiveness of the treatment procedure.

BIOMEDICAL WASTE DECONTAMINATION (AUTOCLAVES)[16]

Infectious wastes can be effectively decontaminated using an autoclave. Autoclaves should be operated at 1210°C (2500°F) for a minimum exposure time of 20 minutes. Autoclaves must be tested regularly to verify that they are operating properly. Chemical indicators which change colour when a certain temperature is reached may be used to check operating temperatures. Another type of indicator is steam dependent tape, where ink appears on contact with steam; this method does not test the contents of packages as it is placed on the outside of the packages. The most accurate testing method involves the use of biological indicators.

Did you know?

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[16] CDC - Guideline for Disinfection and Sterilization in Healthcare Facilities
http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/Disinfection_Nov_2008.pdf

Records should always be kept of all biological indicator tests. Autoclaves function efficiently through proper control of pressure, temperature, moisture content, time and contact. Clear procedures must be developed and used by all those responsible for autoclaving. Regular autoclave calibration and maintenance are also required.

Focus

Preparation of items to put in the autoclave

- Remove soil from items.
- For sterilization, wrap items in muslin or other approved wrap (not aluminum foil).
- For sterilization or decontamination, load wrapped or unwrapped items into containers that are made of metal or heat-resistant plastic, not more than 25 cm. deep. Avoid stacking items or crowding items tightly into the autoclave.
- Fasten closed plastic "autoclave bags" for transport to the autoclave, but unfasten them for autoclaving to ensure steam penetration. For the same reason, remove lids from lidded containers and autoclave them separately.

CHEMICAL DISINFECTANTS

Chemical disinfectants are used to decontaminate surfaces, reservoirs of infectious material, and to clean up spills of infectious material. The choice of chemical disinfectant must be made carefully based on:

- Types of organisms, suspected or known.
- Items or surfaces to be decontaminated.
- Hazards posed to the HCW by the disinfectant.
- Cost of disinfectant.
- Corrosiveness of disinfectant.
- Shelf life and required dilution of disinfectant.
- Material which inactivates the disinfectant.

In many cases, the choice of disinfectant for specific uses may be standardized in the organization and made after evaluation by IPC and OHS professionals.

Considerations in the use of chemical disinfectants

Did you know?

- As much as possible, know what the possible contaminants are.
- Choose the disinfectant carefully. More than one may be required. Keep in mind the items to be disinfected, and the properties and limitations of the various available disinfectants. If more than one disinfectant is required, ensure that those selected are chemically compatible.
- Follow the manufacturer's directions for making the proper dilutions of the disinfectants.
- The effective life of disinfectants can vary depending on the formulations and the conditions of usage. Follow the manufacturer's directions.
- The effective exposure time that the disinfectant must be in contact with the contaminant will also vary with conditions of usage. Often overnight exposure may be recommended to ensure effective decontamination.
- Understand the health and safety hazards that may be posed by a particular disinfectant and ensure appropriate precautions are taken. Wear disposable gloves when using any disinfectants. Wear other PPE or clothing as necessary, depending upon the disinfectants. Consult Material Safety Data Sheets for details.
- HCWs with particular sensitivities to specific disinfectants should avoid using those disinfectants.
- Perform tests of the disinfectants to ensure effective disinfection.

The efficient and effective control of a biological spill requires that all staff members are trained in and have practiced the established spill response techniques. The materials and supplies that are necessary for spill clean-up and decontamination must be readily available to ensure timely spill response. Written spill response procedures should outline spill response actions and roles. The actual procedure used will vary with the size of the spill and the location of spill (including materials, equipment or environmental surfaces affected). All spill responses should be documented as incidents.

Focus

A biological spill kit should contain:

- Biological liquid solidifying agent.
- Disinfectant - small quantities, made fresh daily if phenolics or hypochlorites (such as bleach).
- Forceps for picking up broken glass.
- Paper towels, swabs, disposable and heavy-duty gloves.
- Metal or polypropylene (autoclavable) dust pan.
- Heavy-duty polyethylene bags.
- High efficiency particulate respirators, shoe covers or rubber boots and full protective clothing if large spills may occur.

Ultraviolet Germicidal Irradiation Units (UVGI)

UVGI is an air-cleaning technology that is sometimes used in air ducting, a room, or a corridor to irradiate the air by means of a UV source. Studies funded by the National Institute for Occupational Safety and Health[17] conducted in 2003 found:

- Increasing the irradiance level of the UVGI lamps increased the effectiveness of inactivating the TB-like bacteria. The relationship was linear up to a certain level. Further increasing the irradiance above this high level resulted in little increase in the inactivation of the airborne TB-like bacteria.
- High relative humidity above 75 percent lowered the effectiveness of UVGI to inactivate the TB-like bacteria.
- Mostly, ventilation and UVGI worked together to remove or inactivate the airborne TB-like bacteria at a greater rate than either system working alone. Low to moderate levels of ventilation in the room did not negatively affect UVGI effectiveness.
- The study clearly demonstrated that the air in a room must be mixed for UVGI to effectively inactive the TB-like bacteria. When warm air entered the room via a duct close to the ceiling (which may occur in the winter when the heating system is turned on), the warm air simply "rested" on the much cooler air below and the efficacy of the UVGI system was dramatically diminished. No mixing fans were on during this experimentbut moderate ventilation was present.

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[17] NIOSH Update: NIOSH-Funded Study Simulates Hospital Room to Test UV System for Employee TB Protection; 2003; **http://www.cdc.gov/niosh/updates/uvsysfortb.html**

To function properly and minimize potential hazards to HCWs and other room occupants, upper-air UVGI systems must be properly installed, maintained, and labeled in accordance with manufacturer's specifications. A UVGI system designer should be consulted before purchasing and installing a UVGI system.

According to the CDC Guideline for Disinfection and Sterilization in Healthcare Facilities[18], "the application of UV radiation in the health-care environment (i.e., operating rooms, isolation rooms, and biologic safety cabinets) is limited to destruction of airborne organisms or inactivation of microorganisms on surfaces.... No data support the use of UV lamps in isolation rooms, and this practice has caused at least one epidemic of UV-induced skin erythema and keratoconjunctivitis in hospital patients and visitors."

FACILITY DESIGN

Numerous factors contribute to biological safety in the healthcare environment and design of a facility plays a crucial role in controlling the spread of infectious agents. The choice of materials for environmental surfaces should take into account their absorption characteristics, as well as their ability to be cleaned and decontaminated. For this reason, porous materials such as rugs and curtains are discouraged in healthcare facilities.

As hand hygiene has been demonstrated to be an important factor in preventing the transmission of infectious organisms, hand washing sinks should be provided in sufficient numbers and strategically placed (e.g. near room entry/exit points) so as to be readily accessible to HCWs. Touchless fixtures contribute to decreasing transmission of microorganisms by eliminating the need for HCWs to contact faucets for sink operation. Waterless hand sanitizers should also be considered as part of a hand hygiene program and sanitizers should be placed strategically for ready HCW access. Emergency eyewashes and showers must be provided and maintained if there is a risk of eye or body exposure to biological agents.

Process flows of people, equipment, materials, and wastes should be considered to control the spread of infectious agents. Segregation and management of equipment, materials and wastes that are potentially infectious should be considered in facility design. Ventilation requirements should be defined and planning for new facilities or renovations should include consultation by IPC and OHS professionals. Facility design should ensure ease of access to mechanical equipment so that routine maintenance can be performed.

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[18] CDC - Guideline for Disinfection and Sterilization in Healthcare Facilities **http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/Disinfection_Nov_2008.pdf**

Laboratories should follow Health Canada Guidelines to ensure proper containment facilities for the biological hazards likely to be encountered. Many infection control standards relate to design of healthcare facilities and should be consulted for an in depth treatment of the subject.

Checklist

In the Centers for Disease Control and Prevention publication MMWR[20], the issue of environmental considerations related to infection prevention and control was reviewed. Key recommendations included reviewing the following:

☐ Infection-control impact of ventilation system and water system performance.

☐ Establishment of a multidisciplinary team to conduct infection-control risk assessment.

☐ Use of dust-control procedures and barriers during construction, repair, renovation, or demolition.

☐ Environmental infection-control measures for special areas with patients at high risk.

☐ Use of airborne-particle sampling to monitor the effectiveness of air filtration and dust-control measures.

☐ Procedures to prevent airborne contamination in operating rooms when infectious tuberculosis (TB) patients require surgery.

☐ Guidance for recovering from water-system disruptions, water leaks, and natural disasters (e.g., flooding).

☐ Infection-control concepts for equipment using water from main lines (e.g., water systems for hemodialysis, ice machines, hydrotherapy equipment, dental unit water lines, and automated endoscope reprocessors).

☐ Environmental surface cleaning and disinfection strategies with respect to antibiotic-resistant microorganisms.

☐ Infection-control procedures for health-care laundry.

☐ Use of animals in health care for activities and therapy.

☐ Managing the presence of service animals in health-care facilities.

☐ Infection-control strategies for when animals receive treatment in human health-care facilities.

☐ Call to reinstate the practice of inactivating amplified cultures and stocks of microorganisms onsite during medical waste treatment.

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[20] "Guidelines for Environmental Infection Control in Health-Care Facilities Recommendations of CDC and the Healthcare Infection Control Practices Advisory Committee (HICPAC)" MWR: Recommendations and Reports: June 6, 2003 / 52(RR10): 1-42: **http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5210a1.htm**

Consultation regarding infection control issues during renovation should occur to prevent "designing in" risks. The CSA Standard "Z317.13-07 Infection Control During Construction, Renovation and Maintenance of Health Care Facilities" should be adhered to.

Administrative Controls

A COMPREHENSIVE SYSTEM INTEGRATING IPC AND OHS OBJECTIVES

A comprehensive management system considers the continuum of IPC efforts across all sites and operations. It includes attention to patient, resident, visitor, contractor, volunteer and HCW safety. The system should be based on the premise that IPC and OHS are everyone's responsibility. The system must adequately address any current or new legislation that defines governance, accountability and responsibilities to support patient and HCW health, safety and quality control. The system must also reflect requirements established by regulatory bodies for the various health professions.

A comprehensive system should include the following components (not an all-inclusive list):

- A process that ensures comprehensive hazard assessments are conducted for all sites and tasks and appropriate controls are identified.
- An IPC plan with clear designation of roles and responsibilities.
- Coordinated activities and policies related to IPC and OHS that ensure a consistent approach to IPC for patients, visitors, residents and HCWs.
- Consistent standards for the cleaning, disinfection and sterilization of equipment.
- Procedures, and policies including Routine Practices, Additional Precautions, hand hygiene policies and facilities, patient risk assessments, communication protocols, decontamination of clothing and dedicated clothing.
- Hands free or no touch techniques for the passing of instruments in the Operating Room.
- Outbreak prevention and management.

- ☐ Adequate staffing to comply with OHS and IPC policies and procedures; work scheduling; plans to address surge capacity.
- ☐ Required orientation and ongoing education.
- ☐ Biomedical waste handling procedures and policies.
- ☐ Guidelines for infrastructure requirements to support effective IPC and OHS; the use of technical standards to ensure IPC is incorporated into new or renovated facilities.
- ☐ Supporting systems that include Engineering/Physical Plant, Housekeeping, Materials Management and Facilities Planning to ensure:
  - Adequate housekeeping and waste management services.
  - Appropriate processes for cleaning, decontamination, disinfection and sterilization of patient care equipment.
  - Purchasing processes to include consideration of safety factors.
- ☐ A comprehensive surveillance and monitoring plan.
- ☐ Record keeping and regular reporting of outcomes.

OHS and IPC professionals have overlapping responsibilities to ensure effective prevention and management of infectious diseases in the healthcare environment. Inconsistent standards and approaches confuse both patients and HCWs and create anxiety in times of outbreaks or epidemics.

Checklist

Working together effectively to provide optimal IPC to ensure patient and HCW safety. ✓

- ☐ The IPC Committee includes OHS professionals (both occupational health practitioners and safety specialists).
- ☐ The OHS Committee includes IPC professional(s).
- ☐ Both IPC and OHS issues are covered in orientation and training, preferably jointly to demonstrate links.
- ☐ OHS policies related to infectious disease identification and management are discussed and receive input from IPC professionals.
- ☐ IPC policies related to infectious disease identification and management that affect HCWs are discussed and receive input from OHS professionals.

Checklist

☐ HCWs are provided with and are required to use highest available and appropriate controls until evidence indicates a lower level of protection is adequate.

☐ IPC and OHS follow guidance of provincial and federal regulators and agencies as required when determining appropriate controls; ensuring compliance with both OHS and IPC standards and regulations.

☐ Communication pathways about potential outbreaks or disease notification are well established and include OHS where HCWs may be impacted.

☐ The roles of OHS, IPC and Public Health in outbreak management are clearly defined and understood.

EFFECTIVE HOUSEKEEPING AND MAINTENANCE PROGRAMS

Regular building maintenance is important in controlling exposure to infectious agents. This includes early detection and remediation of transient odours that may be caused by indoor air quality problems, water quality testing, fixing any leaks and resulting damaged materials promptly, and maintaining heating, ventilation and air conditioning (HVAC) systems.

Good housekeeping practices reduce exposure to contaminated equipment and surfaces through regular cleaning and disinfection. Without adequate housekeeping, infection prevention and control would be impossible.

HCW IMMUNIZATION AND HEALTH SURVEILLANCE

An immunization policy and program is a proactive mechanism to reduce risk of communicable diseases for HCWs. Each healthcare organization should have an immunization and health surveillance program in place that is appropriate to the size and type of workplace. Immunization and health surveillance programs should include:

- Education about vaccine-preventable diseases.
- Risk assessment to determine the need for immunization or surveillance based on potential exposure.
- Administration of immunizations (or referral for immunizations, as appropriate).
- Documentation and follow-up of any baseline health assessments, communicable disease status and immunizations.

Ideally, the immunization and surveillance programs should provide easy, authorized access to HCW immune status records for follow up of exposure incidents and outbreaks. In some cases, immunizations or baseline testing may be required prior to commencement of work. Not all healthcare workplaces have occupational health nurses to administer immunizations. In some workplaces, immunizations are available through the Public Health Department. When this is the case, records of HCW immunizations should be kept separate from those of the public to enable ease of access in situations such as outbreaks. Some organizations require HCWs to obtain the required or recommended immunizations from their family physicians, and bring documentation of the immunization to the employer for record-keeping. Others may contract immunization services from external contractors.

HCW rights must always be considered in an immunization and health surveillance program. HCWs usually have the option of having immunizations; some choose not to have the recommended immunizations. For record-keeping, employers may retain copies of signed HCW refusal statements for immunizations that were offered and declined. In all cases, access to immunization status information must be readily available in urgent situations.

Checklist

Does your organization have an HCW immunization program?

- ☐ Has the organization determined the types of immunizations that will be required or recommended for HCWs?
- ☐ Are risk areas determined that require regular TB testing and any job-specific immunizations?
- ☐ Are the risk assessments conducted by OHS and IPC or Public Health professionals?
- ☐ Are new HCWs immunized or required to show proof of immunization prior to starting work?
- ☐ Is there documentation of HCW refusals of immunizations?
- ☐ Is documentation of the immune status of HCWs readily available to authorized staff for consultation in outbreaks or other incidents?
- ☐ Are all HCW medical records kept in a secure location and accessed by authorized personnel only?
- ☐ Is there an active annual influenza immunization program in the organization that includes targeted HCW groups, annual goals, easy accessibility of immunizations, and documentation of immunizations given?
- ☐ Does the immunization program include consideration of immunocompromised HCWs, or those not vaccinated during an outbreak?

DOCUMENTED, COMMUNICATED AND ENFORCED POLICIES AND PROCEDURES

Establishing and communicating policies sets the foundation for the organization's culture and expectations regarding the prevention of HCW exposure to biological hazards. Policies and procedures should be consistent with best practices and should ensure compliance with applicable legislation. Policies and procedures that address biological hazards are best determined with input from IPC, OHS, Public Health, frontline HCWs, and other stakeholders (depending upon the subject of the policy or procedure). To ensure that IPC, Public Health and OHS policies and procedures are understood and enforced, adequate supervision must be provided and performance monitored. The following types of policies and procedures should be developed, communicated and enforced:

Infection prevention and control policies and procedures – key aspects from an OHS perspective include:

» Management commitment to the protection of HCWs from infectious diseases (biological hazards) through the establishment of IPC plans, policies and strategies.

» Management commitment to provide appropriate resources including expertise, time for training and program development, equipment (including PPE), incorporation of IPC and OHS considerations in construction or renovation projects and in the purchasing of equipment.

» Designation of roles and responsibilities.

» An infection prevention and control committee that includes OHS representation.

» Awareness of hazards of biological agents to HCWs; determination of potential hazards and determination of routes of transmission.

» Cooperate with OHS in the determination of risk levels for HCWs that are the basis for PPE requirements.

» Communication mechanisms between OHS and IPC and between facilities to ensure that proper precautions are taken.

» Development of OHS policies regarding infectious diseases by OHS with consultation of IPC professionals.

» Safe work practices and procedures, including Routine Practices, Additional Precautions, ventilation requirements, hand hygiene, use of needleless systems and engineered safe needle devices, use of PPE, and cleaning and disinfection procedures.

- An emergency outbreak plan and management team.
- Spill response procedures for biological spills.
- Requirements for training.
- Quality assurance procedures.
- The requirement to comply with OHS and WCB legislation.

Occupational Health policies and procedures to include:

- Any required baseline or periodic health assessments.
- The requirement to comply with OHS and WCB legislation.
- The requirement for systematic hazard identification and risk assessments for biological hazards for all tasks/work sites.
- Immunization requirements, procedures and records.
- Communicable disease status.
- Assessment and follow-up for work-acquired infectious diseases
- Work restrictions (when appropriate) for unimmunized HCWs, infected HCWs, HCWs who are asymptomatic carriers of infectious organisms, etc. that include back to work procedures.
- A reporting, investigation and follow-up process for workplace exposures.
- A commitment to the use of controls following the hierarchy of desirable controls (elimination, engineering controls, administrative controls, and PPE).
- The commitment of the organization to provide appropriate controls to prevent or minimize impacts of exposure to biological agents.
- Involvement of HCWs in program development and monitoring.
- The inclusion of IPC or Public Health professionals as consultants to the Joint OHS Committee.
- Safe working procedures to prevent exposure to biological hazards.
- The selection of controls to incorporate the principle of using the highest available and appropriate control measures when the hazard is unknown or uncharacterized.
- Required training for preventing infectious disease transmission.
- Annual objectives related to reduction of exposure incidents and regular. Performance reporting, including annual influenza immunization campaigns.

OHS and IPC coordinated policies and procedures that address:

- OHS role in outbreak management, including contact tracing.
- Confidentiality and maintenance of HCW medical records.
- Surveillance of HCW exposures or potential exposures to infection, including data collection, analysis and communication of results.
- Occupational health screening/surveillance (health surveillance; fitness to work under specific circumstances (e.g. pink eye, norovirus); health screening as required for PPE; baseline health assessments).
- Management of HCWs with specific health conditions that carry an increased risk of exposure to infections (including susceptible immuno-deficient HCWs, pregnant or nursing women, etc.).
- Respiratory protection code of practice, PPE selection, purchasing and management (including HCW involvement, fit testing, medical assessment for respirator use, record keeping, maintenance, stocking and storage of PPE).
- Guidelines for PPE use - PPE management, requirements and guidelines for use and cleaning/decontamination.
- Separate locker rooms/lunch rooms for work areas.
- Contractor safety program to ensure any external service providers comply with OH and IPC programs.
- Workplace Hazardous Materials Information System (WHMIS) Program.
- Transport of Dangerous Goods (TDG) Program.
- OHS and IPC input into renovation or building plans and purchasing decisions.

ROUTINE PRACTICES

Hand hygiene is a key infection prevention measure. Hand hygiene continues to be a major focus of infection prevention efforts in healthcare facilities. "Defined by Health Canada, Routine Practices form the foundation for limiting the transmission of microorganisms in all health care settings and is the generally accepted care for all clients. Elements of Routine Practices are: hand hygiene; risk assessment related to client symptoms, care and service delivery, including screening for infectious diseases; risk reduction strategies through the use of PPE, cleaning of environment, laundry, disinfection and sterilization of equipment, waste management, safe sharps handling, client placement and healthy workplace practices; and education of healthcare providers, clients and families, and visitors.[21]"

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[21] "Standards for Prevention and Management of Methicillin-Resistant *Staphylococcus Aureus*" Alberta Health and Wellness, 2008; available at **http://www.health.alberta.ca/documents/IPC-MRSA-Standards-2008.pdf**

WORK SCHEDULING/ACCOMMODATION

Work scheduling is another administrative control to prevent occupational exposure to infectious disease. Specific examples of work scheduling/ accommodation include:

- During outbreaks, non-immune HCWs may need to be scheduled to work in locations where there is less risk of exposure.
- HCWs who are asymptomatic carriers of specific microorganisms may be required to be removed from the care of patients who are susceptible.
- HCWs that are unable to wear respirators may be excluded from situations in which they are likely to require respirators or be provided with alternative respiratory protection.

Work scheduling related to infection prevention and control must consider patient safety and HCW safety. In addition, HCW rights must also be understood and taken into account.

BIOMEDICAL WASTE HANDLING

Proper waste segregation and management helps ensure that infectious diseases are not transmitted from contact with biological waste. Waste management protocols must be firmly established to comply with health and safety and environmental regulations and enforced. Periodic auditing should occur to verify that procedures are being followed. Where possible, biomedical waste can be decontaminated onsite to reduce potential of exposure i.e. during transportation. If this is not feasible, biomedical waste must be secured appropriately in specially designed and labeled containers for transport and removal. A safe, secure holding area must be available for biological waste.

DECONTAMINATION PRACTICES

Procedures to ensure decontamination of surfaces, items, and clothing must be developed and implemented. Contaminated items should not leave the facility or be re-used until decontaminated. Contaminated clothing should be laundered according to facility procedures. It can be beneficial to have a change of clothing available to HCWs in case uniforms and clothing becomes excessively soiled or contaminated during job duties.

TRAINING

Training in biological hazards and controls should be provided to all HCWs. Each HCW must understand the facility's IPC and OHS programs as it relates to their job duties. For newly hired HCWs all relevant IPC and OHS policies and procedures must be provided to them before they start work. To ensure that HCWs understand and apply this information to their jobs, specific training should also be provided to address job-specific biological hazards.

Periodic refresher training to reinforce policies and procedures and introduce any new practices will benefit all HCWs. Competency should be assessed for all training, and training records should be maintained.

Legislated Requirements

> Under the OHS Regulation, Section 15, if a worker may be exposed to a harmful substance at a work site, employers must:
>
> » Establish procedures that minimize the worker's exposure to the harmful substance.
>
> » Ensure that a worker who may be exposed to the harmful substance is trained in the procedures, applies the training and is informed of the health hazards associated with exposure to the harmful substance.
>
> Workers are required to cooperate with training requirements.
>
> Where HCWs may be exposed to airborne biohazardous material, an employer must ensure that a code of practice for respiratory PPE includes annual training. The training should include:
>
> » Information about the airborne biohazardous materials that workers may be exposed to including their potential health effects.
>
> » An explanation of why the particular RPE being used was chosen, including information about its capabilities and limitations and how to test for a satisfactory fit.
>
> » An explanation of how to properly put on and take off the RPE without contaminating oneself or other workers.
>
> OHS Regulation, Section 15, OHS Code Part 4

POST-EXPOSURE FOLLOW-UP MANAGEMENT

Post-exposure management includes management of HCWs exposed to, colonized by, or infected with microorganisms; an outbreak management process for exposures and/or HCWs that are symptomatic or colonized with infectious disease; and access by Occupational Health professionals to utilize medical assessment and diagnostic services for timely follow-up for HCW exposures.

The following algorithm was provided in the Preamble of Health Canada's publication "Infection Control Guidelines – Prevention and Control of Occupational Infections in Health Care"[22], to assist in the management of occupational infectious disease in HCWs. This chart is provided as general guidance only. Specific follow-up will be determined on a case-by-case basis.

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[22] Division of Nosocomial and Occupational Infections, Bureau of Infectious Diseases, Centre for Infectious Disease Prevention and Control, Population and Public Health Branch, Health Canada, 2002.

OCCUPATIONAL HEALTH MANAGEMENT STRATEGY FOR INFECTIOUS DISEASES IN HCWs

OH Management Strategy for Infectious Diseases in HCWs

Responsibilities

Administration

- Resources
- Policies/Procedures
- Risk assessment/risk control measures

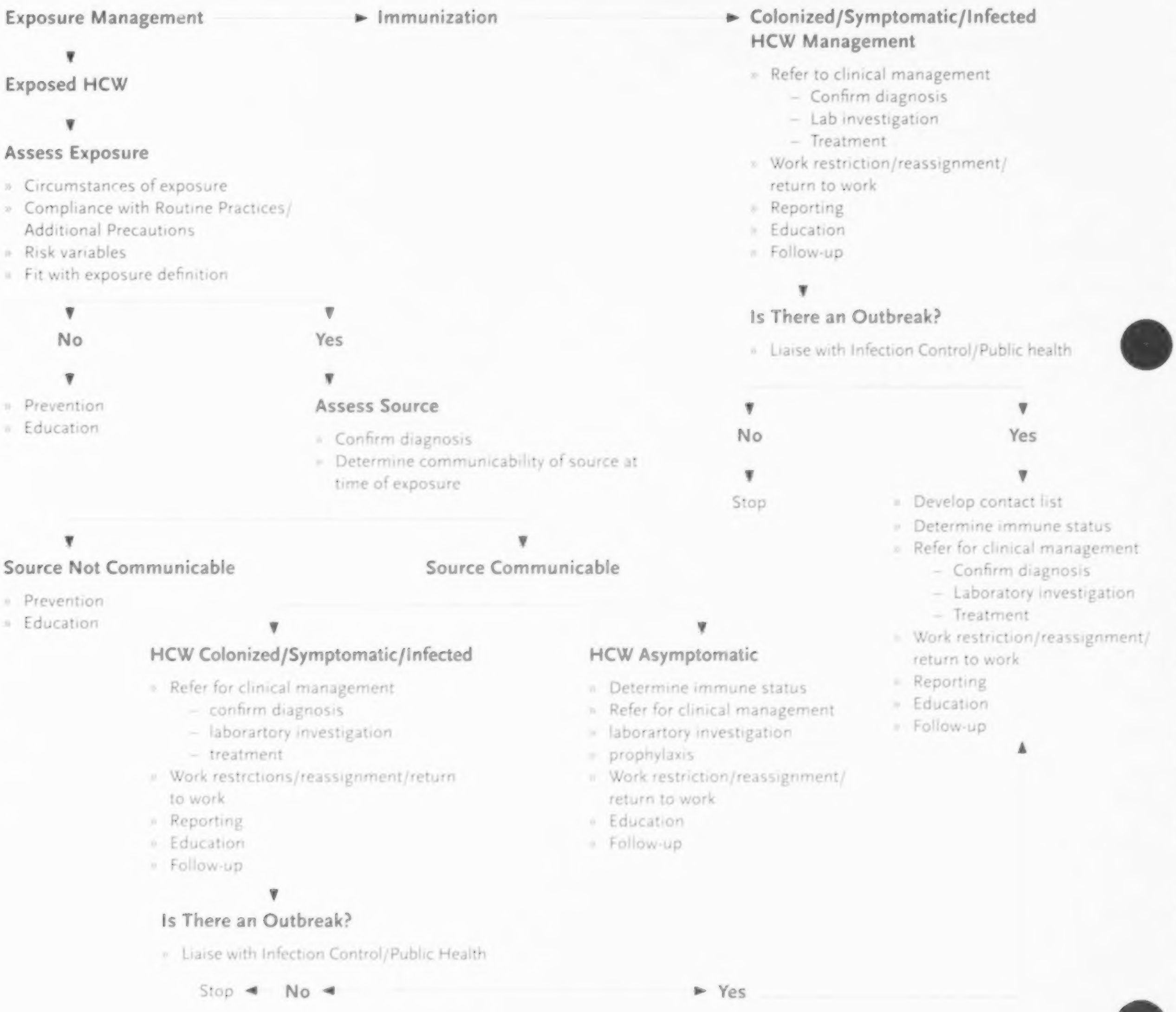
Occupational Health Personnel

- Objectives of OH Program
- Risk assessment/risk control measures
- Policies/procedures
- Resource allocation
- Education
- Evaluation

Health Care Worker (HCW)

- Education regarding infectious diseases and their risks/controls
- Risk assessment/control measures
- Reports of risk situations
- Follows Routine Practices/Additional Precautions
- Reports of exposures, symptoms, infections to OH

Management Strategy



Exposure Management ► **Immunization** ► **Colonized/Symptomatic/Infected HCW Management**

Colonized/Symptomatic/Infected HCW Management

- Refer to clinical management
  - Confirm diagnosis
  - Lab investigation
  - Treatment
- Work restriction/reassignment/return to work
- Reporting
- Education
- Follow-up

Is There an Outbreak?

- Liaise with Infection Control/Public health

No ▼ Stop

Yes ▼

- Develop contact list
- Determine immune status
- Refer for clinical management
  - Confirm diagnosis
  - Laboratory investigation
  - Treatment
- Work restriction/reassignment/return to work
- Reporting
- Education
- Follow-up

Exposure Management

▼

Exposed HCW

▼

Assess Exposure

- Circumstances of exposure
- Compliance with Routine Practices/Additional Precautions
- Risk variables
- Fit with exposure definition

No ▼

- Prevention
- Education

Yes ▼

Assess Source

- Confirm diagnosis
- Determine communicability of source at time of exposure

Source Not Communicable

- Prevention
- Education

Source Communicable

HCW Colonized/Symptomatic/Infected

- Refer for clinical management
  - confirm diagnosis
  - laborartory investigation
  - treatment
- Work restrctions/reassignment/return to work
- Reporting
- Education
- Follow-up

HCW Asymptomatic

- Determine immune status
- Refer for clinical management
- laborartory investigation
- prophylaxis
- Work restriction/reassignment/return to work
- Education
- Follow-up

Is There an Outbreak?

- Liaise with Infection Control/Public Health

Stop ◄ **No** ◄ ► **Yes**

Personal Protective Equipment

PPE is considered the third line of defense. This reflects the reliance on proper selection, fit, use and maintenance of the equipment by the organization and individual HCWs. PPE is often used in conjunction with other controls (engineering and administrative) to provide additional protection to workers. The primary types of PPE are designed to protect the worker from infectious disease by breaking the chain of infection at the "portal of entry or exit" of the microorganisms. This means that all PPE is designed to reduce exposure via specific routes of transmission. Gloves, gowns and other protective clothing reduce exposure through the dermal (skin) contact route and help contain the microorganisms to the work environment. Eye and face protection reduce exposure through mucous membrane contact. Masks worn by patients reduce exposure through droplet containment at the source, and respirators worn by HCWs reduce exposure to the respiratory system.

This section covers the selection and use of key PPE. Common factors that influence the selection of PPE include the route of potential exposure, the durability and appropriateness of the PPE for the required task, and the proper fit of the PPE. It is important to consider the compatibility of PPE to an organization's HCW population to ensure its effectiveness and comfort the users. The employer should ensure that adequate quantities and sizes of PPE are available for HCW use.

EMPLOYERS MUST:

- Identify what personal protective equipment is required and when it is required based on the hazard assessment.
- Ensure workers are trained in personal protective equipment use.
- Ensure workers wear it and use it properly.
- Ensure personal protective equipment is maintained and kept in good condition to perform the function for which it was designed.
- Ensure personal protective equipment meets standards listed in the OHS Code.
- Ensure the use of personal protective equipment does not itself endanger the worker.

WORKERS MUST:

- Workers must use personal protective equipment according to the training and instruction they receive.
- Workers must inspect personal protective equipment prior to use and not use the personal protective equipment if found to be in a condition that makes the personal protective equipment unsuitable for use.

OHS Code, Part 2 & 18

GLOVES

Gloves are the most common type of PPE used in healthcare settings. Gloves are made from a variety of materials including latex, nitrile, neoprene, copolymer, and polyethylene and are available in various levels of thickness. When dealing with infectious materials, gloves must be waterproof. Most patient care activities require non-sterile gloves, whereas any invasive procedure should be performed using sterile surgical gloves. Avoidance of latex gloves is indicated due to the risk of latex allergy unless there is a demonstrated safety requirement for latex to be used. The Canadian General Standards Board (CGSB) certifies medical gloves, which is a key factor in selecting gloves for use in healthcare. The choice of gloves must often balance the needs for protection and dexterity. While thicker gloves (or double gloves) may appear to provide greater protection, it may make tasks more difficult and increase the exposure risk. In Recommendations for Canadian Health Care and Public Service Settings[23], it is noted that the "Selection of the best glove for a given task should be based on a risk analysis of the type of setting, type of procedure, likelihood of exposure to blood or fluid capable of transmitting bloodborne pathogens, length of use, amount of stress on the glove, presence of latex allergy, fit, comfort, cost, length of cuffs, thickness, flexibility, and elasticity."

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[23] *Recommendations for Canadian Health Care and Public Service Settings*; found at **http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/97vol23/23s3/index.html**

Safe Practices for Glove Use[24]

» Wear medical gloves when there is a risk of contact with blood, body fluids or substances, mucous membranes, open wounds or skin lesions.

» Wear gloves that are certified by the CGSB.

» Wear gloves when handling items contaminated with blood, body fluids, secretions or excretions.

» Wear gloves if you have any cuts or lesions on your hands or if you have dermatitis affecting your hands.

» Avoid latex gloves and powdered gloves to reduce sensitization or allergic reactions.

» Ensure that the gloves fit properly.

» Inspect gloves for holes or tears, discarding any damaged gloves.

» Put gloves on just before beginning the task, and remove them promptly when finished and before touching any environmental surfaces.

» Work from "clean to dirty" (touching clean sites or surfaces before dirty or contaminated ones).

» Do not touch your face or adjust PPE with contaminated gloves and avoid touching uncontaminated items such as light switches, telephones, etc. while wearing gloves.

» Change gloves when they become soiled, during lengthy procedures, and between patients.

» Remove gloves carefully according to the IPC guidelines and dispose of them properly.

» Wash hands before using and after removing gloves.

» Never reuse or wash single-use disposable gloves.

» Use sterile gloves when performing invasive procedures.

Focus

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[24] Modified from information provided in Preventing the Transmission of Blood Borne Pathogens in Health Care and Public Service Settings. Found at **http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/97vol23/23s3/index.html**

PROTECTIVE CLOTHING

Protective clothing is necessary to protect skin and prevent contamination of street clothes during all procedures or patient care tasks that may generate splashes of blood, body fluids, secretions or excretions. Protective clothing should be liquid-resistant and be closed in the front (no open neck or v necks). Gowns should be knee length, fasten in the back, and have long sleeves and snug cuffs that can be covered with gloves. Gowns that are too tight restrict movement; gowns that are too large may cause hazards during performance of the tasks.[25] Plastic disposal aprons are used to cover uniforms when there is the potential of a splash of contaminated material.

The common lab coat, made of loose weave cotton or cotton blend, does not provide adequate protection in areas where contact with patient body fluids or airborne hazards is possible. The features of the lab coat that make it unacceptable include its open neck, gap between sleeve and glove, wide cuffs, front opening, and the loose cotton weave or cotton blend is not liquid resistant.[26]

Checklist

Considerations for choosing protective clothing

- ☐ What is the risk of exposure to blood or body substances?
- ☐ What tasks will be performed?
- ☐ Is sterile protective clothing required?
- ☐ Is the protective clothing disposable or reusable after laundering?
- ☐ Does the protective clothing fit properly?
- ☐ How will the protective clothing be handled after use?
- ☐ Does the use of the protective clothing comply with local IPC standards and procedures?

A word about scrubs

Scrubs do not meet requirements for personal protective clothing for HCWs. Scrubs are used as uniforms extensively in healthcare organizations, and should be covered with personal protective clothing when there is risk of exposure to biological hazards. Any uniform or clothing worn by HCWs that may be visibly contaminated should be changed prior to leaving the facility. Protective gowns and any contaminated clothing should be laundered as per facility guidelines.

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[25] "The Proper Fit for PPE", John Roark, Infection Control Today Magazine, Nov. 2004.

[26] **Preventing Occupational Exposures to Blood Borne Pathogens;** Janine Jagger and Jane Perry, International Healthcare Worker Safety Center, University of Virginia, 2004.

HEAD AND FOOT COVERS

From an occupational health and safety perspective, head and foot covers are worn to protect the soiling of head/hair and shoes during procedures that may expose the HCW to blood, body fluids or substances. When foot covers are not specifically required, HCWs should ensure that shoes are completely closed (no open areas such as toes, heels, or "cut-outs"), made of material that is non-absorbent, and have non-skid soles. Head and foot covers should be disposable and discarded appropriately after use.

HCWs often keep "work shoes" in the facility and change from street shoes to work shoes when they arrive at work. Home care workers sometimes carry "work shoes" that meet the approved criteria (see above) to put on when they are in patient homes.

FACE PROTECTION – EYE PROTECTION AND MASKS[27]

PPE is required when there is the potential for exposure of the face to splashes or sprays of infectious material. The selection of eyewear depends upon the tasks being conducted. Types of eye protection include safety glasses, goggles, visors, face shields and table mounted barrier shields.

Legislated Requirements

Eye Protection

The employer is required to ensure that the worker wears CSA approved eye protective equipment if the worker's eyes may be injured or irritated at the work site. For more information refer to: **http://employment.alberta.ca/documents/WHS/WHS-LEG_ohsc_p18.pdf**

OHS Code, Part 4, Section 229

Face shields are not considered full eye protection and should be used in conjunction with other eye protection (e.g. goggles); while safety glasses should not be used for protection from significant liquid splashes. Regular prescription eyewear and contact lenses are not considered effective as PPE. Safety eyewear should fit the wearer, be clean and well maintained and stored. If necessary, goggles may be fitted with prescription lenses or worn over glasses. Anti-fog, untinted and scratch-resistant lenses are recommended. One study[28] of 918 HCWs with eye exposures showed a significant reduction in frequency of eye exposures among those wearing goggles or face shields versus no eyewear. Face shields should cover the forehead, extend below the chin, and wrap around the side of the face. There have been cases[29] when HCWs have had eye exposures to infectious material. An analysis of case studies suggested that failures to protect the eyes adequately occurred when blood or body fluids were ejected or squirted under pressure or when the goggles or face shields slipped or left unprotected gaps and lack of full seal around the eyes.

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[27] Material adapted from the US Centers for Disease Control PowerPoint presentation "Guidance for the Selection and Use of Personal Protective equipment (PPE) in Healthcare Settings.

[28] "Blood and Body Fluid Exposures to Skin and Mucous Membranes"; *Advances in Exposure Prevention*, Vol. 1, no.2, 1995; Janine Jagger and Melanie Balon

[29] "Blood and Body Fluid Exposures to Healthcare Workers' Eyes While Wearing Faceshields or Goggles"; *Advances in Exposure Prevention*, Vol. 2, no.4, 1996; Melanie Bentley

Masks protect the mucous membranes of the nose and mouth from exposure to large droplets that may contain infectious materials. Masks are commonly used to contain droplets at the source (for example, the HCW or patient with a cough). Masks should fully cover the nose and mouth and fit snugly. This is facilitated by flexible nose pieces and straps that secure the mask to the head.

It makes sense...

> "Note that the term "mask", as in surgical mask, is used to refer to a device that is worn by a person to minimize the spread of airborne contaminants from that person's respiratory tract and to protect other persons from exposure. As such, surgical masks are therefore not recognized by regulators as an approved design for respiratory protection, even though they may offer some degree of protection."
>
> From **Protecting the Faces of Health Care Workers**[30]

Some infection prevention and control documents[31] suggest the use of a "good quality surgical/procedure mask covering the nose and mouth when providing direct care within one metre of the patient" (with febrile respiratory illness) as a droplet/contact precaution. While this "one metre rule" is widely accepted in many healthcare organizations, the distinction between droplet and airborne transmission of infectious agents is not always clear. According to the "CDC Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings 2007"[32], "It is likely that the distance droplets travel depends on the velocity and mechanism by which respiratory droplets are propelled from the source, the density of respiratory secretions, environmental factors such as temperature and humidity, and the ability of the pathogen to maintain infectivity over that distance. Thus, a distance of less than 3 feet (or 1 meter) around the patient is best viewed as an example of what is meant by "a short distance from a patient" and should not be used as the sole criterion for deciding when a mask should be donned to protect from droplet exposure. Based on these considerations, it may be prudent to don a mask when within 6 to 10 feet (2 to 3 meters) of the patient or upon entry into the patient's room, especially when exposure to emerging or highly virulent pathogens is likely."

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[30] **Protecting the Faces of Health Care Workers: Knowledge Gaps and Research Priorities for Effective Protection Against Occupationally-Acquired Respiratory Infectious Diseases;** Annalee Yassi and Elizabeth Bryce; Report to Change Foundation, March 2004.

[31] This example is from the document "Preventing Febrile Respiratory Illnesses: Protecting Patients and Staff" produced by the Provincial Infectious Diseases Advisory Committee (PIDAC); Province of Ontario, 2005.

[32] Available at **http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/Isolation2007.pdf**

In the final report of the SARS Commission, it was noted that when it comes to protecting HCWs: "The point is not who is right and who is wrong about airborne transmission, nor is it how far droplets travel. The point is not science, but safety. Scientific knowledge changes constantly. Yesterday's scientific dogma is today's discarded fable. When it comes to worker safety in hospitals, we should not be driven by the scientific dogma of yesterday or even by the scientific dogma of today. We should be driven by the precautionary principle that reasonable steps to reduce risk should not await scientific certainty."

The Difference between a Surgical or Procedure Mask and a Respirator

SURGICAL OR PROCEDURAL MASKS

- Surgical Masks are not designed to seal tightly against the HCW's face or certified to prevent inhalation of small droplets/particles.
- When the HCW inhales, contaminated small droplets can pass through gaps between the face and surgical mask.
- Surgical masks provide a physical barrier for protection from splashes of large droplets of blood or body fluids.
- Surgical masks are used for several purposes including:
    - Prevention of accidental contamination of patients wounds with pathogens normally present in mucus or saliva.
    - Placed on sick patients to limit spread of infectious respiratory secretions to others.
    - Protection from splashes or sprays of blood or body fluid.
    - Assist to keep HCWs contaminated hands from contacting their own mucous membranes.

RESPIRATORS (I.E. NIOSH APPROVED N95)

- A fit-tested NIOSH approved respirator, provides a proper seal at the HCWs face, forcing inhaled air to be pulled through the filter material and not through gaps between the face and the respirator.
- Respirators are designed to reduce HCW's exposure to airborne contaminants.
- Fit tested NIOSH approved respirators are used when required, based on hazard assessment.

*Adapted from OSHA (2007) *Guidelines on Preparing Workplaces for an Influenza Pandemic*

Did you know?

RESPIRATORS

Employers are required to use engineering and administrative controls before using PPE (respecting the hierarchy of effective controls). Respirators are required to protect HCWs from exposure to biohazardous material via inhalation. Many factors affect the nature and exposure circumstances of a worker's exposure to biohazardous material through inhalation, also called airborne biohazardous material, and impact the determination of the need for RPE. These include:

a. The type of biological agent.

b. The route of transmission.

c. The pathogenicity of the agent.

d. Concentration of the agent.

e. Size of airborne particles.

f. Duration of exposure.

g. Work activity.

h. Work practices and procedures for which exposure to biohazardous material is possible.

Respiratory Protective Equipment

If a worker is or may be exposed to exposure to an airborne biohazardous material, the employer must assess the work site to determine if workers need to use respiratory protective equipment (RPE) and provide worker the appropriate RPE where indicated. For more information refer to: **http://employment.alberta.ca/documents/WHS/WHS-LEG_ohsc_p18.pdf**

OHS Code, Section 244

The employer must consider the nature and the exposure circumstances of any contaminants or biohazardous material. The employer must provide and ensure the availability of RPE appropriate to the worker's exposure circumstances. Where the hazard assessment identifies the need for RPE some of the requirements include:

Training

Employer must ensure all workers receive appropriate education, instruction or training with respect to hazards they may be exposed to and procedures and controls used to reduce exposure.

Code of Practice

If respiratory equipment is used at a work site, an employer must prepare a code of practice governing the selection, maintenance and use of the RPE. In the case of a health care worker who may be exposed to airborne biohazardous material, the code of practice includes training, done on at least an annual basis, on:

- Information about the airborne biohazardous materials that workers may be exposed to including their potential health effects.
- The particular respiratory protective equipment used chosen, including information about its capabilities and limitations and how to test for a satisfactory fit.
- How to properly put on and take off the RPE without contaminating oneself or other workers.

Approval of Equipment

Employer must ensure that RPE required at a work site is approved by NIOSH or another standard setting and equipment testing organization, or combination of organizations, approved by a Director of Occupational Hygiene.

Effective Face Seal

Employer must ensure that RPE that depends on an effective facial seal for its safe use is correctly fitted and tested in accordance with CSA Standard (Z94-4-02).

OHS Act, Section 33 and OHS Code, Part 18

Legislated Requirements

Checklist

What to consider in determining the need for RPE?

☐ Who is potentially exposed to the biohazardous material a part of their work?

☐ What are the potential sources and routes of transmission to workers?

☐ Which job tasks increase the potential for worker exposure to biohazardous material at the workplace?

☐ Can the biohazardous material be spread to workers through airborne transmission?

Resources

Respiratory Code of Practice

The OHS Code requires an organization that uses respirators to have a respiratory code of practice governing the selection, maintenance, and use of respiratory protection equipment. As required by section 8 of the *Alberta OHS Regulation*, the procedures contained in the code of practice must be in writing and available to workers. For more information refer to Guideline for the Development of a Code of Practice for Respiratory Protective Equipment, available at: **http://employment.alberta.ca/documents/WHS/WHS-PUB_ppe004.pdf**

The standard for fit-testing of respirators, in general, requires that workers who are required to wear respirators are fit-tested at least every two years and trained in the proper use and maintenance of the respirators. Fit-testing requirements include a health assessment to ensure that HCWs are medically able to wear respirators. If the effectiveness of the respirator depends upon proper sealing to the face, the wearer must be clean shaven where the respirator seals to the face. Fit-testing may be done using either quantitative or qualitative methods, but must be done for all respirators that are tight fitting. The two major types of respirators are air-purifying and atmosphere supplying, based on their modes of operation[34].

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[34] This section is modified from information found in **PPE Made Easy – A Comprehensive Checklist Approach to Selecting and Using Personal protective Equipment**, Jeffrey O. Stull, Government Institutes 1998.

Features of air-purifying respirators (APRs)

- Remove contaminants from the air as it is inhaled into the facepiece.
- Provide protection to wearer from inhalation of hazardous contaminants.
- Are not to be used in oxygen-deficient atmosphere.

Two types of APRs are non-powered and powered. Non-powered APRs operate by the breathing action of the wearer. When the wearer inhales, potentially contaminated air is drawn through the filtering material. The breath is expelled through an exhalation valve or through the filtering material. Powered APRs (PAPRs) have an air blower that blows air through a filter and supplies air to the facepiece. The air purifying filters of APRs are fibrous materials that remove particles by gravity settling, impaction, diffusion, and/or electrostatic attraction.

Features of atmosphere-supplying respirators

- Provide the wearer with a source of air independent of the ambient air.
- Can be used in oxygen deficient atmospheres.

Types of atmosphere-supplying respirators include supplied air respirators and self-contained breathing apparatus (SCBA). Supplied air respirators use airlines or hoses connected to air pumps, compressors or compressed air cylinders. A SCBA uses a source of air that is carried on the body of the wearer. The following chart[35] is useful in choosing the appropriate respirator type.

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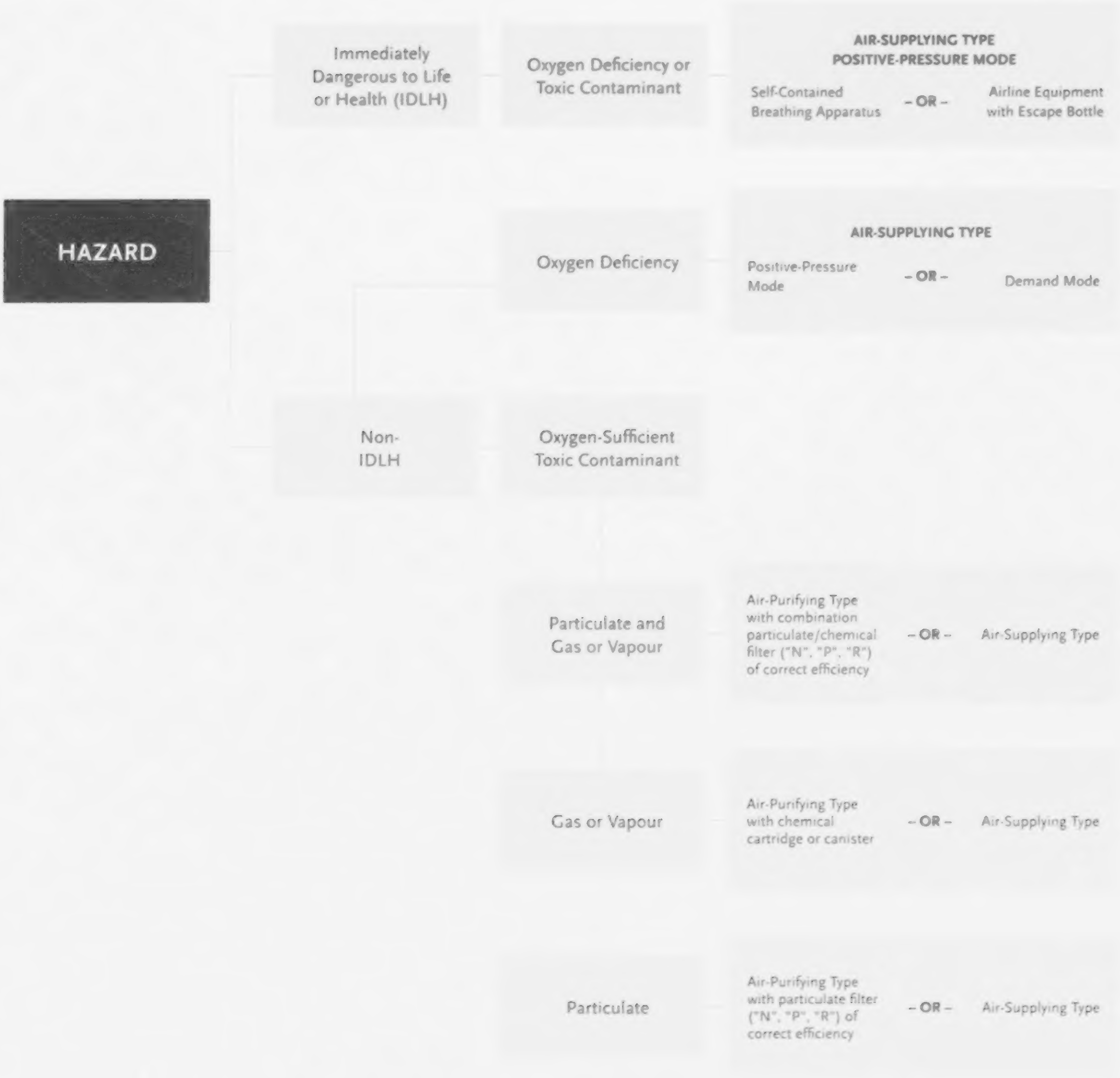
[35] "*Respiratory Protective Equipment: An Employer's Guide*, Alberta Human Resources and Employment; Workplace Health and Safety Bulletin PPE001-Breahtring Apparatus; April 2005.

Choosing an Appropriate Type of Respiratory Protective Equipment


HAZARD
Immediately Dangerous to Life or Health (IDLH)
Oxygen Deficiency or Toxic Contaminant
AIR-SUPPLYING TYPE POSITIVE-PRESSURE MODE
Self-Contained Breathing Apparatus
– OR –
Airline Equipment with Escape Bottle
Oxygen Deficiency
AIR-SUPPLYING TYPE
Positive-Pressure Mode
– OR –
Demand Mode
Non-IDLH
Oxygen-Sufficient Toxic Contaminant
Particulate and Gas or Vapour
Air-Purifying Type with combination particulate/chemical filter ("N", "P", "R") of correct efficiency
– OR –
Air-Supplying Type
Gas or Vapour
Air-Purifying Type with chemical cartridge or canister
– OR –
Air-Supplying Type
Particulate
Air-Purifying Type with particulate filter ("N", "P", "R") of correct efficiency
– OR –
Air-Supplying Type

The most common type of respirator used in healthcare for protection from biohazardous material is an air-purifying respirator (usually a half-face piece) with a high efficiency filter. NIOSH classifies these as "N" (not oil resistant), "R" (oil resistant), or "P" (oil proof). These have filtering efficiencies of 95%, 99%, or 99.97%. N95 respirators are often chosen as the basic level of respiratory protection for HCWs with the potential of exposure to airborne contaminants. Based on the hazard assessment, a higher level of protection may be required. In the event that there is a duty to accommodate a HCW who cannot wear a specific type of respirator, alternative types/models may be required.

Checklist

Does your organization have a respiratory protection program?

☐ Have potential biological respiratory hazards been identified for the various tasks/jobs in the organization?

☐ Are hazard assessments updated regularly or when there is a change in tasks?

☐ Are engineering and administrative controls in place where possible?

☐ Does the organization have a respiratory code of practice?

☐ Have HCWs who may be required to wear respirators been identified?

☐ Have the appropriate types and levels of respiratory protection been identified?

☐ Are only NIOSH-approved respirators selected?

☐ Do HCWs receive a medical assessment to ensure they are medically capable of wearing respirators?

☐ Are HCWs fit-tested for the appropriate respirators?

☐ Is fit-testing repeated at least bi-annually, or when there is any change in the facial structure (such as weight loss or surgery)?

☐ Are HCWs trained in the selection, use, and maintenance of respiratory protection?

☐ Are HCWs trained to perform seal checks?

Checklist

☐ Is refresher training provided for the donning and doffing of respirators?

☐ Are HCWs aware of the limitations of respirators?

☐ Do HCWs have a copy of a list of respiratory protection equipment for which they have been successfully fit-tested?

☐ Are records kept of all fit-test results?

☐ Are sufficient numbers, types and sizes of respirators stored by the organization in keeping with potential demand and are available at the point of use?

Section 6

Examples of Selected Biological Agents – Transmission, Controls and Follow-up

Section 6: Examples of Selected Biological Agents – Transmission, Controls and Follow-up

This section[36] will provide a brief overview of selected infectious agents of concern to HCWs. This is not a textbook and will not delve into details about each organism. Rather it will present a brief risk assessment, information about transmission, and suggested "best practices" for controlling exposures. **Note that this list is not extensive or all-inclusive.** While some of these agents are relatively common, several are very rare and have not been associated with occupational transmission. They are included because they have been the subject of concern for some HCWs. For more detailed guidelines about infectious diseases, refer to the Alberta Government's Public Health Notifiable Disease Management Guidelines[37]. For additional information about OHS issues related to infectious diseases, consult the Alberta Health Services Infection Control Manual online. Appendix 2 contains Material Safety Data Sheets that present more detail about these organisms as occupational hazards.

Agents that are transmitted by blood, body fluids, and other body substances

HIV

Agent/Disease:

Human Immunodeficiency Virus (HIV) can cause Autoimmune Deficiency Syndrome (AIDS), which affects the immune system, leaving the infected person with greatly increased susceptibility to a wide range of disorders.

Transmission:

Workplace transmission may occur following contact with blood or with body fluids such as saliva, semen, vaginal secretions, cerebral spinal fluid (CSF), or other body fluids visibly contaminated with blood. Transmission may also occur as a result of contact with unfixed tissue or organs, as well as cultures that contain the virus. Both direct transmission (sharps injury or open cuts or mucous membrane exposures), as well as indirect transmission (contact with contaminated surfaces) may occur.

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[36] This section is summarized from information found in Healthcare Hazard Control and Safety Management, Second Editions, James T. Tweedy, Taylor & Francis, CRC Press, ISB# 978-1-57444-306-6; 2005; the Alberta Government's Public Health Notifiable Disease Management Guidelines available at **http://www.health.alberta.ca/professionals/notifiable-diseases-guide.html** *Infection Control Guidelines – Prevention and Control of Occupational Infections in Health Care;* Division of Nosocomial and Occupational Infections, Bureau of Infectious Diseases, Centre for Infectious Disease Prevention and Control, Population and Public Health Branch, Health Canada, 2002; and **Infection Prevention and Control – Theory and Practice for Healthcare Professionals;** Debbie Weston; John Wiley & Sons, Ltd., 2008; ISBN 978-0-470-05907-4.

[37] **http://www.health.alberta.ca/professionals/notifiable-diseases-guide.html**

Risk Assessment factors:

High risk HCWs include those providing direct patient care (doctors, nurses, dentists, nursing aids, phlebotomists, diagnostic imaging and nuclear medicine personnel, physiotherapists and respiratory therapists, emergency response personnel, community health workers), laboratory workers, and those providing support services (cleaning rooms, etc.).

Major controls:

ENGINEERING: Engineered needlestick prevention devices are widely used as an engineering control. Appropriately designed sharps containers placed at the point of usage and appropriate laboratory containment equipment should be provided.

ADMINISTRATIVE: There is no vaccination against HIV. Education of the workforce to ensure understanding of risks of HIV transmission and controls is an important administrative control. Routine Practices and other Infection Prevention and Control procedures are major administrative controls. Hands free or no touch techniques for the passing of instruments in the Operating Room should be employed. Good hand hygiene, protection of any areas of broken skin, sharps safe handling procedures and spill response procedures should be well established and communicated.

PPE: PPE includes use of disposable gloves, aprons/gowns, eye and face protection when there is the possibility of contact with blood and/or body fluids or contaminated surfaces.

HCW Post-Exposure Follow-up:

Testing of source patients with unknown HIV status following a blood or body fluid exposure to a HCW is a common practice and assists in determining any follow-up that may be required. A risk assessment is usually performed on the source patient (usually through a questionnaire process and blood testing, with the patient's informed consent) if the HIV status is unknown to assist in the determination of risk of HIV presence in the patient. Blood tests are performed on both the source patient and the HCW. Information about the status of the source patient may be accessible under the Mandatory Testing and Disclosure Act (for more information http://www.health.alberta.ca/documents/MTDA-Fact-Sheet.pdf). Depending upon results of the risk assessment, the HCW may be offered anti-retrovirals (preferably started within 2 hours of exposure) to reduce the risk of becoming infected. Counseling is another important follow-up to HCW exposure.

Hepatitis B

Agent/Disease:

Hepatitis B virus (HBV) is a serious concern for HCWs, as it can cause debilitating illness as well as a "chronic carrier" state (10% of those infected may become chronic carriers). Chronic carriers are at increased chance for long-term complications. The US Department of Health and Human Services and International Agency for Research on Cancer (IARC) has listed Hepatitis B as a known carcinogen.

Transmission:

While primarily spread as a blood-borne pathogen, transmission may also occur through contact with semen, vaginal secretions, and saliva. Infection occurs through transmission of body fluids, exposure to mucous membranes, or through breaks in the skin. The virus is resilient, surviving on surfaces for up to seven days.

Risk Assessment factors:

High risk HCWs include those providing direct patient care (doctors, nurses, dentists, nursing aids, phlebotomists, diagnostic imaging and nuclear medicine personnel, physiotherapists and respiratory therapists, emergency response personnel, community health workers), laboratory workers, and those providing support services (cleaning rooms, etc.).

Major controls:

ENGINEERING: Engineered needlestick prevention devices are widely used as an engineering control. Appropriately designed and placed sharps containers and appropriate laboratory containment equipment should be provided. Hepatitis B vaccine is a widely used engineering control.

ADMINISTRATIVE: The most effective control is the immunization of all those HCWs who may come into contact with HBV. Hepatitis B vaccination series should be offered or required based on a risk assessment for exposure. Hepatitis vaccine is not required if the vaccine is contraindicated for medical reasons or if immunity is confirmed through antibody testing. In most organizations, Hepatitis B vaccine may be refused by the HCW (who often is required to sign a declination form). IPC procedures are major administrative controls. Hands free or no touch techniques for the passing of instruments in the Operating Room should be employed. Good hand hygiene, housekeeping and instrument cleaning procedures, protection of any areas of broken skin, sharps safe handling procedures and spill response procedures should be well established and communicated.

Education of the workforce to ensure understanding of risks of HBV transmission and controls is an important administrative control. Proper spill response also limits exposure.

PPE: PPE includes use of disposable gloves, aprons/gowns, eye and face protection when there is the possibility of contact with blood and/or body fluids or contaminated surfaces.

HCW Post-Exposure Follow-up:

Post exposure follow-up to a known Hepatitis B surface antigen positive patient may include passive immunization with hepatitis B immunoglobulin or active immunizations (vaccine) for the potentially exposed HCW. Counseling is another important element of follow-up to HCW exposure.

Hepatitis C

Agent/Disease:

This RNA virus causes an infection of the liver that results in a high percentage (approximately 70% - 80%) of infected people becoming chronically infected. Infected individuals may be asymptomatic for many years, as symptoms become evident only once the liver is extensively damaged. The US Department of Health and Human Services and International Agency for Research on Cancer (IARC) has listed Hepatitis C as a known carcinogen.

Transmission:

Transmission occurs predominantly through direct percutaneous exposure.

Risk Assessment factors:

High risk HCWs include those providing direct patient care (doctors, nurses, dentists, nursing aids, phlebotomists, diagnostic imaging and nuclear medicine personnel, physiotherapists and respiratory therapists, emergency response personnel, community health workers), laboratory workers, and those providing support services (cleaning rooms, etc.). Transmission occurs more often in people with large or repeated direct exposure to blood or blood products.

Major controls:

ENGINEERING: Engineered needlestick prevention devices are widely used as an engineering control. Appropriately designed and placed sharps containers and appropriate laboratory containment equipment should be provided.

ADMINISTRATIVE: There is no vaccination against Hepatitis C virus (HCV). Education of the workforce to ensure understanding of risks of HCV transmission and controls is an important administrative control. Routine Practices and other Infection Prevention and Control procedures are major administrative controls. Hands free or no touch techniques for the passing of instruments in the Operating Room should be employed. Good hand hygiene, protection of any areas of broken skin, sharps safe handling procedures and spill response procedures should be well established and communicated.

PPE: PPE includes use of disposable gloves, aprons/gowns, eye and face protection when there is the possibility of contact with blood and/or body fluids or contaminated surfaces.

HCW Post-Exposure Follow-up:

Post-exposure prophylaxis with antiviral treatment may be provided if the source is known to be HCV positive or if the status is unknown. Counseling is another important element of follow-up to HCW exposure.

Clostridium difficile[38]

Agent/Disease:

The C. difficile bacteria have been associated with outbreaks of diarrhea among health care patients or residents. It can be a very serious condition for individuals who are immuno-compromised.

Transmission:

The major route of transmission is by direct contact with contaminated people or their feces, but it can also be spread from contact with environmental surfaces. Some of those infected may become asymptomatic carriers of the bacteria. In healthcare organizations, transmission between patients may be related to poor hand hygiene of caregivers.

Risk Assessment factors:

Generally HCWs (even those taking antibiotics) are not susceptible to the bacterium.

Major controls:

ENGINEERING: Controls are primarily designed to reduce the transmission of the infection between patients. Engineering controls include the use of dedicated equipment or decontamination of reusable equipment.

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[38] This information was taken from an Ontario Ministry of Labour Urgent Advisory "Information on Clostridium difficile-Associated Disease (CAD) for Health Care Workers", Nov. 22, 2006: **http://www.labour.gov.on.ca/english/hs/ua_c-difficile.html**

ADMINISTRATIVE: Administrative controls include enforcement of hand hygiene practices, not consuming food or beverages in patient care areas, and the use of contact precautions. Avoid transfer of patients with C. difficile to other units. Environmental cleaning and disinfection procedures are important administrative controls.

PPE: HCWs should wear gloves and aprons/gowns when there is direct patient contact or contact with contaminated surfaces.

HCW Post-Exposure Follow-up:

While C. difficile is not occupationally acquired, if a HCW is infected with C. difficile, they should remain off work.

Noroviruses

Agent/Disease:

Single-stranded RNA viruses (also known as small round structured viruses) and Norwalk-like viruses can cause outbreaks in healthcare organizations that impact both patients and HCWs. Infection results in sudden onset of watery profuse diarrhea and may also produce projectile vomiting. This is particularly dangerous for immuno-compromised individuals.

Transmission:

Noroviruses are extremely contagious and have a high infection rate, affecting 50% or more of HCWs and patients. Transmission is through dissemination of viral particles in the air (which may settle on hard surfaces that become contaminated), as well as by oral-fecal spread.

Risk Assessment factors:

Early detection is critical. A well-understood definition of diarrhea will reduce the required follow-up procedures.

Major controls:

ENGINEERING: Engineering controls include the isolation or cohorting of symptomatic patients, decontamination and sterilization of equipment.

ADMINISTRATIVE: Administrative controls include safe work procedures (especially for dealing with vomit and feces), restriction of visitors and ward closures, good spill response procedures, procedures for decontamination of equipment and environmental surfaces, and HCW training and awareness related to norovirus controls. Good hand hygiene is a primary control for the spread of Noroviruses. Symptomatic HCWs are removed from the work environment until they are asymptomatic for 48 hours.

PPE: PPE includes disposable aprons/gowns and gloves, changed after contact with an infected patient or potentially contaminated equipment or environmental surface.

HCW Post-Exposure Follow-up:

Symptomatic HCWs are removed from the work environment until they are asymptomatic for 48 hours.

Salmonella

Salmonella bacteria are pathogens of the gastrointestinal tract and are the second most common cause of bacterial gastroenteritis. Various strains of Salmonella have been associated with food-poisoning, as well as enteric fevers.

Transmission:

Transmission is primarily through consumption of contaminated food, and may be spread by asymptomatic carriers involved in food handling or preparation. The disease may also pass from the infected feces of people to other people.

Risk Assessment factors:

While the illness is usually self-limiting, it may pose significant risk in the very young, the elderly or other immuno-compromised individuals. There have been cases documented of hospital-acquired Salmonella that have resulted from food handling processes, which have led to recommendations for best practices in food handling.

Major controls:

ENGINEERING: Properly functioning temperature-controlled heating/freezing, storing and handling of food.

ADMINISTRATIVE: Infection control procedures to prevent fecal-oral route transmission should include isolation procedures, hand hygiene, visitor instructions for hand decontamination, linen handling practices, attention to handling of clinical waste, bed pan washer standards, equipment decontamination, and environmental cleanliness standards. Food safety procedures are another important administrative control.

PPE: Gloves and aprons/gowns should be worn for contact with body fluids or excretions; these should be removed and discarded as medical waste before leaving the patient's room. Eye/face protection should be worn if there is the potential for splashes or sprays of infectious material.

HCW Post-Exposure Follow-up:

Infected HCWs require treatment with antibiotics and exclusion from work until cleared by OHS or Public Health. Reassignment to a low risk area may be used as an alternative to exclusion. HCWs who are carriers and excretors of the bacteria may pose a significant risk in food handling areas. Healthcare facility outbreaks may require testing of HCWs who may be carriers or excretors.

Methicillin-resistant Staphylococcus aureus (MRSA)

Agent/Disease:

MRSA has often been considered a hospital-acquired infection, though there are an increasing number of cases of community acquisition. Staphylococcus aureus that is resistant to the antibiotic methicillin may cause a wide range of infections from localized skin infections to deep-seated infections and systemic infections. There is a potential for MRSA to reach epidemic proportions in hospitals, as the infections are more difficult to treat and have delayed recovery times. Colonization without symptoms also may occur for periods of time in both patients and HCWs.

Transmission:

In a healthcare facility, transmission is by direct patient contact, usually on the hands; there is also the possibility of spread from contaminated equipment, such as stethoscopes or the handling of contaminated ID tags.

Risk Assessment factors:

There is an increased risk to HCWs caring for MRSA patients if the staff member has skin conditions such as eczema or psoriasis.

Major controls:

ENGINEERING: Engineering controls include patient placement (sequestering), early diagnosis, and screening for some types of patients. Isolate the patient where indicated. Use single-use or dedicated equipment where possible.

ADMINISTRATIVE: IPC procedures are major administrative controls including cohort staffing, hand hygiene, cleaning and disinfection procedures, post-discharge cleaning and communication of patient status when transferring patients or sending patients for diagnostic testing. Staff screening is not routinely done,unless there is evidence of cross contamination between patients.

HCWs who are at increased risk for MRSA due to conditions such as eczema or psoriasis should not be assigned to work with MRSA patients. Policies and procedures should be in place to promote the judicious use of antibiotics in order to limit the development and spread of antibiotic-resistant microorganisms.

PPE: Gloves should be worn when contact with body fluids is possible or when handling contaminated linens or dressings. Aprons/gowns should be worn by cleaning service providers. Respiratory protection should be worn based on the hazard assessment.

HCW Post-Exposure Follow-up:

HCWs exposed to MRSA are not routinely screened for MRSA. There are no modifications to work practices or work restrictions for HCWs exposed to MRSA. If the HCW has a draining lesion, exclude from work or provide alternative work placement until treatment is complete, lesions have resolved, medical assessment is performed and appropriate control measures and fitness for work have been determined.

Neisseria meningitides

Agent/Disease:

Neisseria meningitides can cause community-acquired meningococcal disease.

Transmission:

Nosocomial transmission from patient to HCWs is uncommon. There have been some reported cases of transmission from patient to HCW through contact with respiratory secretions or laboratory specimens. It is thought to be transmitted by large droplets. Higher risk activities include mouth-to-mouth resuscitation and endotracheal intubation and tube management.

Risk Assessment factors:

There is a greater risk of transmission if Neisseria meningitidis has caused a lower respiratory tract infection and the patient has a productive cough.

Major controls:

ENGINEERING: Isolation of patient until they have received 24 hours of antibiotic therapy.

ADMINISTRATIVE: Infection control guidelines for droplet transmission.

PPE: PPE includes use of disposable gloves and aprons/gowns for direct contact with patient secretions or contaminated equipment. Eye and face protection when there is the possibility of contact with blood and/or body fluids splashes. Respiratory protection consistent with procedures (highest level protection available if aerosol generating procedures are being performed).

HCW Post-Exposure Follow-up:

Post exposure prophylaxis is available to HCWs who have had unprotected contact. HCW with active meningococcal infection should be excluded from work until 24 hours after the start of effective antibiotic therapy.

Prions (Proteinacious Infectious particles)

Agent/Disease:

Creutzfeldt-Jakob Disease (CJD) is a rare, degenerative, fatal prion disease.

Transmission:

Transmission pathways are still uncertain, through CJD is thought to be transmitted through contact with contaminated tissues or material or equipment that has come into contact with a patient with CJD. There is a theoretical possibility of transmission through blood or blood products, but evidence for this transmission pathway is lacking.

Risk Assessment factors:

Highest risk tissues include brain, spinal cord, spinal ganglia posterior, pituitary gland, eye, dura mater, cranial nerves and cranial ganglia.

Major controls:

ENGINEERING: Single-use disposable equipment is to be used whenever possible and destroyed by incineration. Interventions are to be performed in the operating room whenever possible. Use incineration as method of decontamination. Use biological safety cabinets in laboratories for specimen handling.

ADMINISTRATIVE: Perform risk assessment for surgical/endoscopy patients. Routine Practices and other Infection Prevention and Control procedures are major administrative controls. Train HCWs in precautions and spill response procedures. Schedule procedures (such as tissue processing) at end of list to allow for sufficient clean-up time. Minimize the number of HCWs for procedures. Properly label all specimens and store in sealed containers. Keep records related to decisions regarding quarantined instruments.

PPE: PPE includes use of liquid repellent operating/lab gown worn over a plastic apron, gloves, mask and goggles or full face visor.

HCW Post-Exposure Follow-up:

Conduct individual risk assessment to identify the type of prion disease associated with injury, route of exposure, and the tissues involved. Encourage bleeding of the wound. Wash wound with detergent; irrigate eyes or mouth with saline or tap water. Local excision of inoculated area and secondary prophylaxis treatment may be required. Provide counseling to exposed HCWs.

Streptococcus pyrogenes (flesh-eating disease)

Agent/Disease:

Invasive Group A Streptococcus (GAS) causing necrotizing fasciitis.

Transmission:

Transmission is through contact with oral or nasal secretions of infected patient/HCW or by contact with infected fluids and drainage from wounds.

Risk Assessment factors:

Immuno-deficient HCWs may be at higher risk.

Major controls:

ENGINEERING: Engineering controls include isolation and use of single-use or dedicated equipment.

ADMINISTRATIVE: Routine Practices and other IPC procedures are major administrative controls. Good hand hygiene, decontamination procedures of any multi-patient equipment and environmental cleaning should be well established and communicated.

PPE: PPE includes use of gloves and aprons/gowns if there is direct contact with patient or equipment in patient environment. Eye and face protection should be used if there is the potential for mucous membrane exposure.

HCW Post-Exposure Follow-up:

Prophylaxis with antibiotics may be required for exposed HCWs. Infected HCWs should be seen by a physician and treated with antibiotics. Infected HCWs are excluded from work until effective antibiotic therapy has been given for 24 hours and any drainage has stopped.

Agents transmitted through the respiratory tract

Mycobacterium tuberculosis[39]

Agent/Disease:

Tuberculosis (TB) is caused by Mycobacterium tuberculosis, bacteria that are slow-growing and non-spore-forming. The initial site of infection is usually the lung, though tuberculosis may affect many parts of the body. TB is also associated with HIV as the resulting immuno-suppression of the HIV patient predisposes them to infection with TB.

Transmission:

Transmission usually occurs from patients who are positive for acid-fast bacilli with smear-positive pulmonary or laryngeal TB. Transmission is via droplets and droplet nuclei, ranging from larger sizes which lodge in the upper respiratory tract to droplet nuclei which remain suspended for prolonged periods. Droplet nuclei can become airborne and transmitted via ventilation systems and lodge in the deep recesses of the respiratory tract.

Risk Assessment factors:

Risk of transmission depends on patient factors, environmental factors, and susceptibility of the exposed individuals. Duration of exposure needed for transmission is usually prolonged, but can be much shorter in highly infectious people. Regular surveillance (routine serial tuberculin skin testing) of HCWs likely to come into contact with TB may reduce risk to HCWs.

Major controls:

ENGINEERING: Engineering controls include isolation of infected persons, use of negative pressure rooms and use biological safety cabinets in laboratories for specimen handling.

ADMINISTRATIVE: According to the Public Health Agency of Canada, all healthcare facilities should have a TB Management Program that includes:

» Administrative Responsibilities Related to the TB Management Program.

» Assessment and Classification of Risk of TB Transmission in the Facility.

» HCW TB Screening and Surveillance Programs.

» Strategies for Managing Suspected or Confirmed Infectious TB.

» Engineering Controls to Minimize TB Transmission.

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[39] This section was modified from information provided in **http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/96vol22/22s1/22s1b_e.html** (Guidelines for Preventing the Transmission of Tuberculosis in Canadian Health Care Facilities and Other Institutional Settings), 1996.

- Personal Respiratory Protection.
- Educational and Counseling Programs for HCWs.
- Liaison with Public Health Authorities.
- Program Review and Evaluation.
- Each of these program elements are described in detail in the referenced document and should be considered "best practices" in a TB management Program.

PPE: PPE includes use of respiratory protection for airborne contaminants (N95 or better), gloves, gowns, protective clothing and eye protection.

HCW Post-Exposure Follow-up:

HCW screening and surveillance programs are established based on risk and provide an administrative control to avoid exposure. The purpose of TB screening and surveillance programs for HCWs is:[40]

- To establish the HCW's current TB infection status.
- To identify HCWs with inactive TB infection and, when appropriate, to offer them preventive therapy to decrease their risk of developing active TB.
- To identify HCWs with active TB and ensure that they are appropriately treated;
- To document conversion rates, i.e., negative to positive.
- To determine if the HCWs identified above acquired their infection within the facility or from the community.
- To ensure public health authorities are notified, as required.
- To monitor the effectiveness of the TB management program.

The following table provided in the reference document provides recommendations for the frequency of on-going HCW surveillance for TB.

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[40] **http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/96vol22/22s1/22s1b_e.html** (Guidelines for Preventing the Transmission of Tuberculosis in Canadian Health Care Facilities and Other Institutional Settings), 1996. © Public Health Agency of Canada, 1996.

Frequency of Ongoing HCW Surveillance for TB

Activity Risk	Health Care Facility Risk	
	High*	**Low***
High[1]	Every 6 months	annually
Intermediate[2]	annually	post-exposure[4]
Low[3]	post-exposure[4]	post-exposure[4]

*** High**

a. >or= 6 individuals with TB seen annually or

b. 1 or more individuals with TB are seen and the ratio of HCWs to TB cases <or= 100

*** Low**

a. < 6 individuals with TB seen annually or

b. the ratio of HCWs to TB cases > 100

NOTES:

1. High-risk activities include activities of personnel who are involved with cough-inducing procedures, autopsy, morbid anatomy and pathology examinations, bronchoscopy and designated mycobacterium laboratory procedures.
2. Intermediate-risk activities include activities of personnel who have regular direct patient contact and work on units with patients with active TB (all personnel, including housekeepers, clerks and maintenance staff).
3. Low-risk activities include activities of personnel who have minimal patient contact (e.g., working in medical records, administration) or regular patient contact but rarely with patients with TB (e.g., obstetrics, gynecology, neonatal intensive care unit).

Coronovirus SARS-coV[41]

Agent/Disease:

The causal agent of SARS has been identified as a newly characterized coronovirus named SARS-coV. The virus was responsible for an epidemic of a severe respiratory illness resulting in more than 800 deaths worldwide in 2002-2005. Prior to its identification and characterization, the SARS virus spread through hospital and community transmission, and resulted in the development of protocols for reducing exposure to heretofore unknown or uncharacterized biological agents.

Transmission:

Transmission is through inhalation of respiratory droplets or particles, close contact with infected individuals, or contact with contaminated surfaces where deposited material may become resuspended and aerosolized.

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[41] Information for this section was modified from material in **Infection Prevention and Control – Theory and Practice for Healthcare Professionals,** Debbie, Weston; John Wiley & Sons, Ltd., ISBN 978-0-470-05907-4; 2008, p.228-240.

Risk Assessment factors:

Early detection and use of controls is critical to reduce exposure to HCWs. Clear guidelines and the provision of appropriate controls are important to ensure compliance with the use of controls. Policies for the implementation of temporary controls (using the highest level of controls available) must be in place if the nature of the organism or the route of transmission is not known for certain.

Major controls:

ENGINEERING: Major controls employed during the SARS outbreak included isolation of patients known or suspected of having SARS, the use of dedicated equipment and negative pressure rooms.

ADMINISTRATIVE: Administrative controls include hand hygiene, cohort staffing, proper waste management, limitation of visitors to infected patients, reduction of number of HCWs working with SARS patients to reduce exposure, close surveillance of HCWs who have worked with SARS patients to identify any early symptoms, proper specimen collection and handling, and notification of infection status to those who would be handling patients. Effective programs are required to provide instruction to HCWs. Surveillance programs should be well established and communicated. Clear direction as to the application of controls will avoid confusion.

PPE: Respiratory protection for airborne contaminants (N95 or better) in addition to gloves, gowns, protective clothing and eye protection.

HCW Post Exposure Follow-up:

HCWs with symptoms following exposure should be medically followed and cleared before returning to work.

Influenza[42]

For the most current information and Alberta guidelines on Influenza, consult **http://employment.alberta.ca/documents/WHS/WHS-PUB_bp002.pdf**

Agent/Disease:

Of primary concern in healthcare is the Influenza A virus, an RNA virus causing systemic symptoms that may lead to complications in patients with underlying respiratory or cardiac conditions. Influenza causes annual outbreaks and epidemics of serious illness; in addition, genetic features of the virus may lead to the development of new strains that pose a threat for pandemics.

Transmission:

Influenza is primarily transmitted through droplet contact of mucous membranes with secretions from infected persons. Airborne transmission is considered possible due to the range of particle sizes of secretions, and contact transmission is possible when deposited particles are resuspended.

Risk Assessment factors:

HCWs are susceptible to influenza both in the workplace and in the community. Risks can be reduced through annual vaccination. HCWs who are immuno-compromised, exposed and un-immunized should be clinically managed. In some cases, antiviral prophylaxis may be considered.

Major controls:

ENGINEERING: Engineering controls include vaccine made available to HCWs.

ADMINISTRATIVE: Early identification of infected individuals and isolation where warranted. Administrative controls include education of HCWs, enforcement of hand hygiene and other infection control practices, as well as policies that reduce HCW exposure.

PPE: Personal protective equipment should be provided and used by all HCWs based on the risk assessment. For further information, refer to Alberta Guidelines at **http://employment.alberta.ca/documents/WHS/WHS-PUB_bp002.pdf.**

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[42] Information adapted from **Infection Control Guidelines – Prevention and Control of Occupational Infections in Health Care;** Division of Nosocomial and Occupational Infections, Bureau of Infectious Diseases, Centre for Infectious Disease Prevention and Control, Population and Public Health Branch, Health Canada, 2002.

HCW Post-Exposure Follow-up:

HCWs who are symptomatic or infected with influenza are normally excluded from work until 7 days from the onset of symptoms unless they have been immunized at least two weeks previously and have started antiviral therapy. Outbreak management may require considerations of work schedules and immunization status of HCWs.

Viruses, fungi and tissue products from laser plumes/dremmels[43,44]

Agent/Disease:

Bioaerosols, viruses, cancer cells, blood fragments and bacterial spores may be present in smoke created through the use of lasers, electrocautery and ultrasonic scalpels on tissues. The vapourized agents may lead to HCW exposure and subsequent health effects. While consideration of exposure is based on theoretical possibility, there are reported cases of human papillomavirus (HPV) found intact in surgical smoke.

Transmission:

Electrocautery-produced particles are quite small (<0.1um aerodynamic size), laser tissue ablation generates particles of approximately 0.3 um, and ultrasonic scalpels can produce particles of 0.35-6.5 um. Transmission is by droplet or airborne exposure, depending upon the particle size and the proximity to the source.

Risk Assessment factors:

Risks are identified for surgeons, nurses, anaesthesiologists, and surgical technicians, and are cumulative and related to proximity to the source.

Major controls:

ENGINEERING: Smoke evacuation systems. The evacuation system should not interfere with procedures, provide enough suction to effectively remove the smoke, and include a filter that reduces environmental contamination.

ADMINISTRATIVE: Safe work procedures (arranging work space to keep the HCW's breathing zone away from plumes) and education related to the nature of the hazard.

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[43] http://www.ccohs.ca/oshanswers/phys_agents/laser_plume.html

[44] *Surgical Smoke and infection control*, E Alp, et. al, Journal of Hospital Infection Control (2006) 62:1-5

PPE: Respiratory protection (N95 or better), eye protection and gloves.

HCW Post-Exposure Follow-up:

HCWs exposed to surgical smoke are followed medically when symptoms occur. Any HCW required to wear a respirator must be properly fit-tested and trained according to standards.

Building-related pathogens

Legionella

Agent/Disease:

Legionella pneumophila is a gram-negative rod bacterium that has been identified in causing the majority of cases of legionellosis. Other species of Legionella also cause legionellosis. Legionellosis is associated with two illnesses: Legionnaires' disease, which is characterized by fever, myalgia, cough, pneumonia, and Pontiac fever, which does not include pneumonia.

Transmission:

Transmission is by inhalation of droplets, sprays, or mists of water contaminated with the bacteria. Cooling towers, evaporative condensers, humidifiers, and domestic water systems have been associated with legionellosis. The disease cannot be transmitted from one person to another. Transmission can also occur by aspiration when eating, drinking or during choking.

Risk Assessment factors:

Risk of transmission depends on susceptibility of the exposed individuals, the level of contamination of the water source and contact with aerosolized water. Illness occurs most frequently in individuals over 50 years old, especially those who smoke, have diabetes or chronic lung disease, or are immuno-compromised.

Major controls:

ENGINEERING: Design and maintain water services to prevent or control the growth and multiplication of Legionella i.e. ensure water cannot stagnate in systems, remove redundant piping, water treatment, control release of water spray, keep water clean, ensure distribution of hot water above 50°C, maintain cold water below 20°C, and maintain clean taps, shower heads, and hot tubs.

ADMINISTRATIVE: Inspect water systems regularly, clean and disinfect systems regularly and education related to nature of hazard. Procedures should be in place for investigation of outbreaks and decontamination of sources.

PPE: PPE includes use of respiratory protection when investigating for possible sources of contamination.

HCW Post-Exposure Follow-up:

Post-exposure prophylaxis with antibiotics is required when Legionnaires' disease is diagnosed by chest x-rays and laboratory results.

Stachybotrys

For the most current Alberta Government information about moulds, consult Best Practices Mould at the Work Site at **worksafely.org**.

Agent/Disease:

Stachybotrys is a genus of fungi that includes approximately 10 species. Of these, *Stachybotrys chartarum* is the most common and well known. *Stachybotrys chartarum* is found in the indoor environment on materials with high cellulose content including paper and gypsum wallboard. *Stachybotrys chartarum* is toxigenic as it can create compounds that are toxic to humans. Irritation and allergic reactions, similar to hay fever type allergies, are the most common health effects for individuals that are sensitive to moulds.

Transmission:

Transmission is by inhalation, mucous membrane or skin contact.

Risk Assessment factors:

Individuals with allergies or asthma may be more sensitive to moulds and have more severe reactions. Individuals with compromised immune systems or underlying lung disease are at an increased risk of infection.

Major controls:

ENGINEERING: Design and maintain facilities to prevent water intrusion and release, control condensation, regulate (high) humidity levels in indoor air, remediate contaminated building materials under controlled conditions, and rectify water release and intrusion sources.

ADMINISTRATIVE: Regularly inspect building materials that are susceptible to water intrusion, investigate water releases and intrusions, develop safe work procedures for the investigation, assessment and remediation of wet building materials and mould sources. Follow the CSA Standards for "Infection Control During Renovation and Construction in Health Care Facilities".[45]

PPE: PPE includes use of coveralls, gloves, eye and respiratory protection when remediating contaminated areas and investigating potential contamination. The level and types of PPE used is based on the assessment of risk.

HCW Post-Exposure Follow-up:

Assessment by a health professional if conditions warrant.

Aspergillus

Agent/Disease:

Aspergillus is genus of fungi with approximately 180 species that is very common in nature. These species grow on a vast array of organic materials including many building materials. Aspergillosis is the group of diseases caused by Aspergillus. Allergic bronchopulmonary aspergillosis is a condition where the fungus causes allergic respiratory symptoms. Invasive aspergillosis is a disease in which the fungus invades and damages body tissues.

Transmission:

Transmission is by inhalation, mucous membrane or skin contact.

Risk Assessment factors:

Individuals with compromised immune systems, asthma or cystic fibrosis are at an increased risk of infection. Individuals with allergies or asthma may be more sensitive to moulds and have more severe reactions.

Major controls:

ENGINEERING: Design and maintain facilities to prevent water intrusion and release, regulate (high) humidity levels in indoor air, control condensation, remediate contaminated building materials under controlled conditions, and rectify water release and intrusion sources.

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[45] CAN/CSA-Z317.13-07; available at **http://www.csa-intl.org/onlinestore/GetCatalogItemDetails.asp?mat=2019817**

ADMINISTRATIVE: Regularly inspect building materials that are susceptible to water intrusion, investigate water releases and intrusions, develop safe work procedures for the investigation, assessment and remediation of wet building materials and mould sources, develop safe work procedures for renovations and construction that will control the release of dusts. Follow the CSA Standards for "Infection Control During Renovation and Construction in Health Care Facilities".[46]

PPE: PPE includes use of coveralls, gloves, eye and respiratory protection when remediating contaminated areas and investigating potential contamination. The level and types of PPE used is based on the assessment of risk.

HCW Post-Exposure Follow-up:

Post-exposure prophylaxis is required when Invasive aspergillosis is diagnosed by chest x-rays and laboratory results.

Other Moulds

For the most current Alberta Government information about moulds, consult Best Practices Mould at the Work Site at **worksafely.org**.

Agent/Disease:

There are thousands of species of mould. Moulds are common outdoors and will grow indoors where there is moisture. Some moulds are toxigenic: producing mycotoxins (species-specific fungal metabolites which can have toxic effects in humans).

Transmission:

Transmission is by inhalation, mucous membrane or skin contact.

Risk Assessment factors:

Individuals with allergies or asthma may be more sensitive to moulds and have more severe reactions. Individuals with compromised immune systems or underlying lung disease are at an increased risk of infection.

Major controls:

ENGINEERING: Design and maintain facilities to prevent water intrusion and release, regulate (high) humidity levels in indoor air, control condensation, remediate contaminated building materials under controlled conditions, and rectify water release and intrusion sources.

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[46] CAN/CSA Z317.13-07 available at http://www.csa-intl.org/onlinestore/GetCatalogItemDetails.asp?mat=2019817

ADMINISTRATIVE: Regularly inspect building materials that are susceptible to water intrusion, investigate water releases and intrusions, develop safe work procedures for the investigation, assessment and remediation of wet building materials and mould sources, develop safe work procedures for renovations and construction that will control the release of dusts. Follow the CSA Standards for "Infection Control During Renovation and Construction in Health Care Facilities".[47]

PPE: PPE includes use of coveralls, gloves, eye and respiratory protection when remediating contaminated areas and investigating potential contamination. The level and types of PPE used is based on the assessment of risk.

HCW Post-Exposure Follow-up:

Assessment by a health professional if conditions warrant.

Resources

Best practices for dealing with mould specify that the presence of uncontrolled water and the potential presence of mould on a work site present hazards that require assessment and elimination and/or control. The Alberta Government document - Best Practices Mould at the Work Site - should be consulted for important information about environmental mould, its effects, determination and remediation. Available at: **http://employment.alberta.ca/documents/WHS/WHS-PUB_bh019.pdf**

Bird-borne pathogens

For current Alberta Information about Avian Influenza, refer to **http://employment.alberta.ca/documents/WHS/WHS-PUB_bp003.pdf.**

Agent/Disease:

Two noteworthy types of fungus that are known to cause disease are *Histoplasma capsulatum* which causes Histoplasmosis and *Cryptococcus neoformans* which causes Cryptococcosis. The organisms can be found in the droppings of certain types of birds, bats and soil contaminated with their droppings.

Histoplasmosis primarily affects the lungs but the infection can spread to other parts of the body. Cryptococcosis infection may cause a pneumonia-like illness, skin lesions and central nervous system infections.

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[47] CAN/CSA-Z317.13-07: available at **http://www.csa-intl.org/onlinestore/GetCatalogItemDetails.asp?mat=2019817**

Transmission:

Transmission occurs by inhalation when contaminated droppings or soil is disturbed. The disease cannot be transmitted from one person to another.

Risk Assessment factors:

Occupations that involve contact with contaminated droppings or soil are at high risk of acquiring infection. Individuals with compromised immune systems are at an increased risk of infection.

Major controls:

ENGINEERING: Design facilities to exclude roosting areas for birds and bats.

ADMINISTRATIVE: Treat all sources of droppings as being contaminated and provide education related to the nature of the hazard. Remove accumulations of droppings following safe work procedures that include methods to control aerosolization.

PPE: PPE includes use of coveralls, gloves, eye and respiratory protection (N95 or better if airborne exposure is a possibility) when remediating contaminated areas and investigating potential contamination. The level and types of PPE used is based on the assessment of risk.

HCW Post-Exposure Follow-up:

Severe cases of histoplasmosis and cryptococcosis may require treatment with specialized antifungal drugs. Milder cases may not require treatment.

Infestations

Lice[48]

Agent/Disease:

Two types of lice may be transmitted to HCWs from affected patients. These are head lice and body lice.

Transmission:

Adult lice, nymphs and eggs found in hair are responsible for transmission, with direct transmission from head to head contact (head lice) or skin to skin contact (body lice). Transmission can also occur indirectly by contact with head coverings, clothing or bedding.

Risk Assessment factors:

HCWs providing services where they may come into contact with patients who have lice are at higher risk. This may include direct care givers, volunteers, and support staff.

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[48] For further information, refer to the Alberta Health and Wellness Public Health Notifiable Disease Management Guidelines for Typhus Louseborne found at **www.health.alberta.ca/documents/ND-Typhus-Louseborne.pdf**

Major controls:

ADMINISTRATIVE: Follow IPC guidelines. Decontaminate clinical equipment after use. Work procedures should include careful changing of linen and frequent linen changes in the case of body lice. Properly wash all infected linen and clothing.

PPE: PPE includes use of gloves, caps and long-sleeved gowns when treating patients with lice.

HCW Post-Exposure Follow-up:

Exclude HCW from patient contact until completion of treatment, ensuring no nits or lice are present.

Scabies

Agent/Disease:

Skin infestation caused by mites and eggs. Scabies that is severe with wide spread lesions is sometimes confused with eczema.

Transmission:

Scabies is transmitted by direct skin to skin contact for 3 minutes or more, or through contact with contaminated clothing.

Risk Assessment factors:

There is a higher risk if the patient with scabies is more dependant, wanders and is tactile. HCWs who hold hands with the patient are at higher risk for transmission.

Major controls:

ENGINEERING: Use dedicated or single-use equipment.

ADMINISTRATIVE: Communication of the patient's status if transferred or transported to other areas of the facility or to other facilities. Avoid close contact when possible. Properly wash all infected linen and clothing.

PPE: PPE includes use of gloves and long sleeved gowns for direct patient contact.

HCW Post-Exposure Follow-up:

Prophylaxis may be required if there is HCW exposure to scabies; HCWs with scabies should be excluded from work until treated and cleared by a physician.

Hantavirus[49]

Agent/Disease:

The Hanta virus causes hantavirus pulmonary syndrome.

Transmission:

Transmission is by inhalation of aerosolized rodent excreta (urine or feces) contaminated by hanta virus particles. Infection may also occur through rodent bites.

Risk Assessment factors:

Public health workers and individuals in areas where rodents and their excreta are present are at highest risk. Disease occurrence is escalated with the presence and increased numbers of carrier rodents.

Major controls:

ENGINEERING: Prevention of mice from entering facilities by closing off openings. Use mouse-proof storage containers.

ADMINISTRATIVE: Follow established cleaning and disinfection procedures, especially in regards to handling mouse carcasses or excreta. Avoidance of dust generation.

PPE: PPE includes use of gloves and full length clothing when disposing of infected material or mouse carcasses. Respiratory protection is based on the hazard assessment.

HCW Post-Exposure Follow-up:

There are no work restrictions for HCWs exposed to hantavirus. Supportive treatment is recommended, but there are no antivirals currently used for hantavirus.

Agents of bioterrorism

Agents of bioterrorism can fall into a variety of categories. The following chart, taken from the University of Vermont College of Medicine[50] training program summarizes some of the key infection control issues. Note that this table does not address controls for first responders. In the case of first responders[51], the first critical step is the decontamination of the patient.

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[49] For further information, consult the Alberta Government Bulletin – Hantvirus – Information for Employers and Workers found at **http://employment.alberta.ca/documents/WHS/WHS-PUB_bh015.pdf**

[50] Infection Control; Bioterrorism e-mail Module #11: Susan Page, MT, MS, CIC Fletcher Allen Health Care and the University of Vermont College of Medicine. Reprinted with permission.

[51] First responders may find NIOSH recommendations for PPE useful. They can be found at **http://www.cdc.gov/niosh/docs/2009-132/**

Summary of infection control precautions for category 1 bioligical agents

Disease	Incubation Period	Mode of Transmission	Precautions
Anthrax (Pulmonary)	1-7 days: (may be as long as 60 days)	Inhalation of spores	Standard precautions, *no person to person transmission* Initial decontamination of patient (removal of clothes and showering with soap and water) is appropriate
(Cutaneous)	1-7 days	Direct cutaneous contact with spores onto broken skin.	Standard precautions, *no person to person transmission*
(Gastrointestinal)	1-7 days	Ingestion of contaminated food	Standard precautions, *no person to person transmission*
Plague (Pneumonic)	2-3 days	Inhalation of organism if aerosolized; droplet transmission from an infected person; bite of an infected flea	Droplet precautions until 72 hours of antibiotic therapy
(Bubonic)	2-10 days		Standard precautions, *no person to person transmission*
Smallpox	7-17 days	Inhalation of organism if aerosolized; airborne transmission from an infected person (contagious from onset of rash until scabs separate) contact transmission from lesions and clothing linen	Airborne and Contact precautions. Use negative pressure rooms on M6 or B5, wear an N-95 respirator or PAPR. Exposed individuals should be quarantined during the incubation period. Clothing linen must be isolated. Contagious at onset of rash
Tularemia	1-14 days	Inhalation of organism if aerosolized (infecting dose of 10 organisms); contact with infected animals	Standard precautions, *no person to person transmission*
Viral hemorrhagic fevers	2-21 days	Contact with infected blood or secretions, possibly airborne during end-stage disease	Contact and Airborne precautions for end-stage disease. Use negative pressure isolation rooms M6 or B-5, wear N-95 respirators or PAPRs.

Section 7

Best Practices for the Control of Biological Hazards, by Functional Areas

Section 7 - Best Practices for the Control of Biological Hazards, by Functional Areas[52]

Biological hazards have been identified in many areas of healthcare facilities and in many tasks performed by HCWs. Each organization must systematically conduct hazard assessments for tasks performed by HCWs. While it is common to consider the transmission of infectious disease through direct contact with infected patients as a high risk hazard, a careful review of all healthcare workplaces will likely identify a complete range of risks that must be addressed. In this section the most commonly encountered biological hazards and methods to control them in specific healthcare functional areas are presented. Employers should carefully evaluate the potential for exposure to biohazardous materials in all areas and ensure that they have an effective hazard control plan in place. This information will be useful for inclusion into hazard assessments. Please note, this is not designed to be an exhaustive treatment of the subject, but is rather an overview summarizing the most frequently encountered biological hazards in healthcare settings.

General Notes:

The following charts provide basic information about control strategies for commonly occurring biological hazards. Administrative controls for ALL areas include Routine Practices that are to be used as a minimum and Additional Precautions as warranted based on the risk assessment. Worker education and good communication processes are also critical administrative controls. Any PPE selected must be based upon the risk assessment of the task and the environment in which it is used. All legislation related to the selection and use of controls must be followed.

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[52] Adapted from material covered in **Healthcare Hazard Control and Safety Management,** second edition, James T. Tweedy, CRC – Taylor & Francis, 2005, ISBN 1-57444-306-2

Direct Care – Medical Units

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through needle stick injuries, contaminated items and surfaces, exposure to mucous membranes	Engineered needle stick prevention devices; availability of sharps containers for disposal; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	Gloves, protective clothing, eye and face protection
Exposure to airborne biological agents through contact with secretions from infectious patients (coughing, sneezing, etc.) or air contaminated with infectious biological agents	Early detection of infection status; isolation; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include gloves, protective clothing, eye, face and respiratory protection.
Exposure to droplets containing infectious biological agents through contact with patient secretions or contaminated environmental surfaces or equipment	Early detection of infection status; isolation; vaccines	Good housekeeping practices; compliance with all infection prevention and control practices; immunization program; worker education	Gloves, protective clothing, eye and face protection
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Direct Care – Operating Rooms and Surgical Units

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through needle stick or sharps injuries, contaminated items and surfaces, exposure to mucous membranes	Engineered needle stick prevention devices; availability of sharps containers for disposal; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	Gloves, protective clothing, eye and face protection
Exposure to airborne biological agents through contact with secretions from infectious patients (coughing, sneezing, etc.) or air contaminated with infectious biological agents	Early detection of infection status; isolation; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include gloves, protective clothing, eye, face and respiratory protection.
Exposure to droplets containing infectious biological agents through contact with patient secretions or contaminated environmental surfaces or equipment	Early detection of infection status; isolation; vaccines	Good housekeeping practices; compliance with all infection prevention and control practices; immunization program; worker education	Gloves, protective clothing, eye and face protection
Exposure to laser plumes	Local exhaust ventilation; selection of medical devices (lasers). Information available at: **http://www.techstreet.com/cgi-bin/detail?product_id=665838**	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould		

Direct Care – Emergency Rooms

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through contact with the blood of trauma patients, or through needle stick injuries, contact with contaminated items and surfaces, exposure to mucous membranes	Engineered needle stick prevention devices; availability of sharps containers for disposal; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	Gloves, protective clothing, eye and face protection
Exposure to airborne biological agents through contact with secretions from infectious patients (coughing, sneezing, etc.) or air contaminated with infectious biological agents	Early detection of infection status; isolation; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include eye protection, respiratory protection and other protective clothing
Exposure to droplets containing infectious biological agents through contact with patient secretions or contaminated environmental surfaces or equipment	Early detection of infection status; isolation; vaccines	Good housekeeping practices; compliance with all infection prevention and control practices; immunization program; worker education	Gloves, protective clothing, eye and face protection
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Direct Care – Long Term Care Patient Care

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through needle stick injuries, contaminated items and surfaces, exposure to mucous membranes	Engineered needle stick prevention devices; availability of sharps containers for disposal; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	Gloves, protective clothing, eye and face protection
Exposure to airborne biological agents through contact with secretions from infectious patients (coughing, sneezing, etc.) or air contaminated with infectious biological agents	Early detection of infection status; isolation; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include eye protection, respiratory protection and other protective clothing
Exposure to droplets containing infectious biological agents through contact with patient secretions or contaminated environmental surfaces or equipment	Early detection of infection status; isolation; vaccines	Good housekeeping practices; compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include eye protection, respiratory protection and other protective clothing
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Direct Care – Physical Therapy/Occupational Therapy/Respiratory Therapy/Diagnostic Imaging

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to airborne biological agents through contact with secretions from infectious patients (coughing, sneezing, etc.) or air contaminated with infectious biological agents	Early detection of infection status; isolation; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include eye protection, respiratory protection and other protective clothing
Exposure to droplets containing infectious biological agents through contact with patient secretions or contaminated environmental surfaces or equipment	Early detection and communication of infection status; isolation; disinfection/sterilization of equipment; vaccines	Good housekeeping practices; compliance with all infection prevention and control practices; waste management procedures; immunization program; worker education	PPE based on the risk assessment may include eye protection, respiratory protection and other protective clothing
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Direct Care – Dialysis

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through needle stick injuries, blood contamination from dialysis machines; contaminated items and surfaces, exposure to mucous membranes	Dedicated supplies; equipment maintenance and decontamination; engineered needle stick prevention devices; availability of sharps containers for disposal; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	Wear gloves at all times when working with patient; wear goggles when there is the possibility of splash or spray, wear liquid-resistant gowns and dispose of them properly
Exposure to droplets containing infectious biological agents through contact with patient secretions or contaminated environmental surfaces or equipment	Disinfection/sterilization of equipment; early detection of infection status; isolation; vaccines	Good housekeeping practices; compliance with all infection prevention and control practices; waste management procedures; immunization program; worker education	PPE based on the risk assessment may include gloves, eye protection and other protective clothing
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Direct Care – Patient Transport

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through contaminated items and surfaces, exposure to mucous membranes	Use of waterproof, disposable pads if appropriate; communication of infection status; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include gloves, eye protection and other protective clothing
Exposure to airborne biological agents through contact with secretions from infectious patients (coughing, sneezing, etc.) or air contaminated with infectious biological agents	Communication of infection status; isolation; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include gloves, respiratory protection, eye protection and other protective clothing
Exposure to droplets containing infectious biological agents through contact with patient secretions or contaminated environmental surfaces or equipment	Communication of infection status; isolation; vaccines	Good housekeeping practices; compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include gloves, eye protection and other protective clothing
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Direct Care – Dental Offices or Dental Clinics in Healthcare Facilities or Community Care Settings

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to biological agents in blood and saliva of patients through contact with blood and saliva or through contact with contaminated needle or sharp instrument	Equipment to minimize formation of aerosols (rubber dams, high-speed evacuation, etc.); obtain medical history of patients; engineered needle stick prevention devices; availability of sharps containers for disposal; proper disinfection of instruments and decontamination of environmental surfaces, lab supplies and materials; vaccines	Compliance with all infection prevention and control practices; no recapping of needles (even if multiple injections in same patient); safe work procedures to minimize formation of aerosols where possible (proper patient positioning, etc.); proper disposal of waste materials; immunization program; worker education	Use of gloves, eye and face protection when splashes or splatters are possible; gowns or uniforms that should be changed daily or when contaminated
Exposure to respiratory infectious disease through droplet transmission	Medical history of patients; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	Use of gloves, eye and face protection when splashes or splatters are possible; gowns or uniforms that should be changed daily or when contaminated
Exposure to respiratory infectious disease through airborne transmission	Medical history of patients; vaccines	Good housekeeping practices; compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include gloves, respiratory protection, eye protection and other protective clothing
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Direct Care – Community Clinics/ Doctors' Offices

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through needle stick injuries, contaminated items and surfaces, exposure to mucous membranes	Medical history of patients; dedicated handwashing sink; waterless hand sanitizers; engineered needle stick prevention devices; availability of sharps containers for disposal; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education; post-exposure procedures	Gloves, protective clothing, eye and face protection
Exposure to airborne biological agents through contact with secretions from infectious patients (coughing, sneezing, etc.) or air contaminated with infectious biological agents	Medical history of patients; vaccines	Scheduling of patients; limit access to patients by workers not immune; TB screening; compliance with all infection prevention and control practices immunization program; worker education	PPE where warranted based on level of risk may include gloves, protective clothing, face and eye protection, respiratory protection
Exposure to droplets containing infectious biological agents through contact with patient secretions, skin to skin contact, or contaminated environmental surfaces or equipment	Medical history of patients; vaccines; disinfection of equipment; cleaning of toys	Good housekeeping practices; compliance with all infection prevention and control practices; immunization program; proper waste disposal; worker education	PPE based on the risk assessment may include gloves, eye and face protection and other protective clothing (fluid resistant)
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Direct Care – Home Care Providers

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through needle stick injuries, contaminated items and surfaces, exposure to mucous membranes	Early detection and communication of infection status; elimination of use of any unnecessary sharps; engineered needle stick prevention devices; availability of sharps containers for disposal; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	Gloves, protective clothing, eye and face protection
Exposure to airborne biological agents through contact with secretions from infectious patients (coughing, sneezing, etc.) or air contaminated with infectious biological agents	Early detection of infection status; vaccines	Exclusion of non-immune workers from visiting infected clients; immunization program; worker education	PPE based on the risk assessment may include gloves, eye and face protection, respirators, protective clothing
Exposure to droplets containing infectious biological agents through contact with patient secretions or contaminated environmental surfaces or equipment	Early detection of infection status; vaccines; cleaning and decontamination of equipment	Good housekeeping practices; compliance with all infection prevention and control practices; immunization program; worker education	Gloves, protective clothing, eye and face protection
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection
Exposure to zoonotic disease	Risk assessment prior to visit	Confine animals during visit; communication procedures; worker education	Gloves, shoe covers and protective clothing for animal excretion contact

Direct Care – Emergency Response Personnel

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through contact with the blood of trauma patients, or through needle stick injuries, contact with contaminated items and surfaces, exposure to mucous membranes	Safe design of emergency vehicles; engineered needle stick prevention devices; availability of sharps containers for disposal; use of waterproof, disposable pads if appropriate; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	Gloves, protective clothing, eye and face protection
Exposure to airborne biological agents through contact with secretions from infectious patients (coughing, sneezing, etc.) or air contaminated with infectious biological agents	Early detection of infection status; vaccines	Compliance with all infection prevention and control practices; worker immunization; worker education	PPE based on the risk assessment may include gloves, respiratory protection, eye and face protection and other protective clothing
Exposure to droplets containing infectious biological agents through contact with patient secretions or contaminated environmental surfaces or equipment	Medical history of patients; vaccines	Good housekeeping practices; compliance with all infection prevention and control practices; proper disinfection of equipment; proper waste disposal; worker education	PPE chosen based on risk assessment, may include masks or faceshields, eye protection, gloves and protective clothing (fluid resistant)

Support Services – Housekeeping

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through needle stick injuries, contaminated items and surfaces	Engineered needle stick prevention devices; availability of sharps containers for disposal; availability of appropriate biological waste containers; vaccines	Strict observation of infection prevention and control practices, including proper needle disposal by all workers on unit; safe handling of waste bags; worker training in infection prevention and control procedures related to housekeeping; appropriate use of disinfectants; immunization program	Gloves, face protection (appropriate for level of infectious agent)
Exposure to airborne biological agents through contact with secretions from infectious patients (coughing, sneezing, etc.) or air contaminated with infectious biological agents	Communication of infection status; isolation; vaccines	Compliance with all infection prevention and control practices; worker immunization; worker education	PPE based on the risk assessment may include gloves, respiratory protection, eye and face protection and other protective clothing
Exposure to droplets containing infectious biological agents through contact with patient secretions or contaminated environmental surfaces or equipment	Communication of infection status; isolation; vaccines	Good housekeeping practices; compliance with all infection prevention and control practices; immunization program; worker education	Appropriate PPE should be chosen based on risk assessment and may include gloves, protective clothing, eye and face protection
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Support Services – Laundry

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through needle stick injuries	Automated sorting systems; metal detectors in sorting area; engineered needle stick prevention devices; availability of sharps containers for disposal; vaccines	Strict observation of infection prevention and control practices, including proper needle disposal by all workers on patient care units; immunization program; worker education	Puncture-resistant gloves, protective clothing
Exposure to droplets containing infectious biological agents through contact with contaminated laundry	Automated sorting systems; design of work area; vaccines	Sorting procedures designed to reduce exposure; worker education	PPE based on the risk assessment may include gloves, masks, eye and face protection and other protective clothing
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Support Services – Food Services

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through needle stick injuries (needles left on patient trays)		Strict observation of infection prevention and control practices, including proper needle disposal by all workers on patient care units; worker education	
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Support Services – Security

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens or pathogens transmitted in body fluids or secretions to mucous membranes or skin breaks from contact with aggressive infected individuals (bites, contact with patient blood, saliva and other body fluids)	Vaccines	Compliance with infection prevention and control procedures; immunization program; training in intervention procedures; worker education	PPE based on risk assessment
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Support Services – Laboratory/autopsy

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through needle stick, glass slides, tubes, pipettes or other sharps injuries	Engineered needle stick prevention devices; elimination of use of any unnecessary sharps avoid using glass products whenever possible; availability of sharps containers for disposal; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	Gloves, protective clothing, eye and face protection
Exposure to bloodborne pathogens through contaminated items and surfaces, exposure to mucous membranes	Vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	Gloves, protective clothing, eye and face protection
Exposure to airborne biological agents through contact with secretions from infectious patients (coughing, sneezing, etc.) or air contaminated with infectious biological agents	Early detection of infection status; isolation	Compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include gloves, respiratory protection, eye and face protection and other protective clothing
Exposure to droplets containing infectious biological agents through contact with patient secretions or contaminated environmental surfaces or equipment	Use of biosafety cabinets for handling patient samples; early detection of infection status	Good housekeeping practices; compliance with all infection prevention and control practices; spill response procedures; worker education	PPE based on the risk assessment may include gloves, respiratory protection, eye and face protection and other protective clothing
Exposure to biological hazards through specimen accessioning and laboratory testing procedures that generate aerosols	Automated systems where possible; aerosol reduction equipment, including use of centrifuge carriers with lids, use of biosafety cabinets; vaccines	Training in and enforcement of safe work practices; designation of clean/contaminated areas or equipment; immunization program	PPE based on the risk assessment may include protective clothing, gloves, respiratory protection, eye and face protection
Exposure to concentrated doses of biological agents	Use of biosafety cabinets; appropriate containment level facilities; aerosol reduction equipment; vaccines	Aerosol reduction procedures; training in and enforcement of safe work practices; immunization program; worker education	PPE based on the risk assessment may include protective clothing, gloves, respiratory protection, eye and face protection
Exposure to pathogens present in tissues	Appropriate containment level facilities; local exhaust ventilation for grossing; appropriate autopsy room ventilation	Training in and enforcement of safe work practices	PPE based on the risk assessment may include protective clothing, gloves, respiratory protection, eye and face protection
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Support Services – Central Processing

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through needle stick or other sharps injuries	Engineered needle stick prevention devices; availability of sharps containers for disposal; vaccines	Safe work procedures for equipment decontamination; compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include protective clothing, gloves, eye and face protection
Exposure to bloodborne pathogens or pathogens transmitted in body fluids or secretions to mucous membranes by contact with contaminated surfaces	Restrict access to Central Processing to authorized personnel only and require that all visitors must be escorted; vaccines	Safe work procedures for equipment decontamination; compliance with all infection prevention and control practices; immunization program; worker education	PPE equipment based on the risk assessment may include protective clothing, gloves, eye and face protection
Exposure to Creutzfeldt-Jakob disease	Disposable and dedicated surgical equipment whenever possible	Develop specific work procedures; educate employees in the specific hazard	PPE based on the risk assessment may include protective clothing, gloves, eye and face protection
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Support Services – Pharmacy

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens or pathogens transmitted in body fluids or secretions to mucous membranes by contact with contaminated surfaces	Restrict access to Pharmacy to authorized personnel only and require that all visitors must be escorted; vaccines	Safe work procedures for equipment decontamination; compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include protective clothing, gloves, eye and face protection
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Support Services – Biomedical Equipment Management

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens or pathogens transmitted in body fluids or secretions to mucous membranes by contact with contaminated surfaces	Vaccines	Safe work procedures for equipment decontamination; compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include protective clothing, gloves, eye and face protection
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Support Services – Maintenance

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to bloodborne pathogens through needle stick or other sharps injuries	Engineered needle stick prevention devices; availability of sharps containers for disposal; vaccines	Compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include gloves
Exposure to bloodborne pathogens or pathogens transmitted in body fluids or secretions to mucous membranes by contact with contaminated surfaces	Vaccines	Safe work procedures for equipment decontamination; compliance with all infection prevention and control practices; immunization program; worker education	PPE based on the risk assessment may include protective clothing, gloves, eye and face protection
Exposure to Legionnaires' disease bacteria	Maintenance of ventilation systems; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning	Infection prevention and control practices related to building maintenance; worker education	PPE based on the risk assessment
Exposure to moulds	Isolation of work area	Mould investigation, assessment and control protocols; worker education	PPE based on the risk assessment may include protective clothing, respiratory protection, gloves, eye and face protection
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Support Services – Administration

Potential Hazards	Summary of Major Control Strategies		
	Engineering	**Administrative**	**PPE**
Exposure to environmental biological contaminants from ventilation systems, water or food	Maintenance of ventilation systems; early spill clean-up; preventive maintenance of ventilation systems and water supply systems with regular testing to ensure proper functioning; early detection and remediation of mould	Infection prevention and control practices related to building maintenance and food preparation; protocols for construction and renovation projects that reduce contamination; worker education	Use of proper PPE when cleaning contaminated environmental surfaces, including gloves, respiratory protection, and eye protection

Glossary of Terms and Abbreviations

Glossary of Terms and Abbreviations

Definitions were taken from the following Government of Alberta Publications:

- Provincial MRSA - IPC Guidelines
- Standards for Cleaning, Disinfection, and Sterilization of Reusable Medical Devices for all Healthcare Facilities and Settings

Canadian Standards Association (CSA): A not-for-profit, non-statutory, voluntary membership association, engaged in standards development and certification activities. CSA standards reflect a national consensus of producers and users — including manufacturers, consumers, retailers, unions and professional organizations, and government agencies.

Carrier: An individual who is found to be persistently colonized (culture positive) for a particular organism, at one or more body sites, but has no symptoms of infection.

Central Processing Area: A centralized area within a health care setting for cleaning, disinfection or sterilization of medical devices. In community settings and offices, any segregated area where reprocessing of devices takes place away from clients and clean areas (e.g. Central Processing Department (CPD), Central Processing Service (CPS), Central Surgical Supply (CSS), Surgical Processing Department (SPD).

Cohort: Two or more patients colonized or infected with the same organism who are separated physically from other patients who are not colonized or infected with that organism.

Cohort Staffing: The practice of assigning specified personnel to care only for patients known to be colonized or infected with the same organism. Such personnel would not participate in the care of patients who are not colonized or infected with that organism.

Colonization: Occurs when bacteria are present on or in the body without causing illness.

Communicable: Capable of being transmitted from one person to another synonymous with "infectious" and "contagious".

Contact (Direct): Direct contact transmission occurs when transfer of microorganisms results from direct physical contact between an infected or colonized individual and a susceptible host (body surface to body surface).

Contact (Indirect): Indirect contact involves passive transfer of microorganisms to a susceptible host via an intermediate object, such as contaminated hands that are not washed between patients or contaminated instruments or other inanimate objects in the patient's immediate environment.

Contact Precautions: Contact Precautions are a set of practices used to prevent transmission of infectious agents that are spread by direct or indirect contact with the patient or the patient's environment. Contact Precautions also apply where the presence of excessive wound drainage, fecal incontinence, or other discharges from the body suggest an increased transmission risk.

Contaminated: State of having been actually or potentially in contact with microorganisms. As used in health care, the term generally refers to the presence of microorganisms that could be capable of producing disease or infection.

Decolonization: Refers to topical and/or systemic antimicrobial treatment administered for the purpose of eradicating MRSA carriage from the skin, nose and other mucosal surfaces.

Decontamination: The process of cleaning, followed by the inactivation of pathogenic microorganisms, in order to render an object safe for handling.

Disinfectant: A chemical agent used on inanimate objects to destroy virtually all recognized pathogenic microorganisms, but not all microbial forms (e.g. bacterial spores).

Disinfection: A process that destroys some forms of microorganisms excluding bacterial spores; a process that kills most forms of microorganisms on inanimate surfaces.

Hand hygiene: Refers to the process of removing or reducing the number of microorganisms on hand surfaces with soap and water or through the use of waterless hand sanitizers.

Health care facility or setting: A facility or setting in which clients receive health care services including but not restricted to public hospitals and surgical facilities, nursing homes, extended care facilities, long term care facilities, clinics, medical and dental offices, and health units in industry.

High efficiency particulate air (HEPA) filter: An air filter with an efficiency of 99.7 per cent in the removal of airborne particles 0.3u or larger in diameter.

Infection: The entry and multiplication of an infectious agent in the host that occurs when bacteria get past the person's normal defenses and cause disease (e.g., skin bacteria getting into the bloodstream via an intravenous catheter).

Infection prevention and control: Evidence-based practices and procedures that, when applied consistently in health care facilities and settings, can prevent or reduce the risk of transmission of micro organisms to health care personnel, clients and visitors.

Infection prevention and control practitioners: Personnel specially trained and responsible for surveillance of infections, education and consultation of HCWs, clients and the general public, to manage infection prevention and control issues.

Medical device: Any instrument, apparatus, appliance, material, or other article, whether used alone or in combination intended by a manufacturer to be used for human beings for the purpose of diagnosis, prevention, monitoring, treatment, surgery, or alleviation of disease, injury or handicap; investigation, replacement or modification of the anatomy, or of a physiologic process; or control of conception, and which does not achieve its principal intended action in or on the human body by pharmacological, immunological means, but which may be assisted in its function by such means.

Negative pressure: Air pressure differential between two adjacent airspaces such that air flow is directed into the room relative to the corridor and room air is prevented from flowing out of the room and into adjacent areas.

Occupational health and safety: An area of specialization which concerns factors such as working conditions and exposure to hazardous materials that influence the health of workers, and which is concerned generally with the prevention of disease and injury and the maintenance of fitness.

Outbreak: An outbreak is defined in the Communicable Disease Regulation, under the Alberta Public Health Act as: *"a distribution of cases of communicable disease that is unusual in terms of time, place or persons affected"* or an increase in frequency of disease above the background occurrence of the disease.

Personal protective equipment (PPE): Specialized equipment or protective clothing used by health care workers to protect themselves from direct exposure to clients' blood, tissue or body fluids. Personal protective equipment may include gloves, gowns, fluid-resistant aprons, head and foot coverings, face shields or masks, eye protection, and ventilation devices (e.g. mouthpieces, respirator bags, pocket masks).

Routine Practices: The term used by Health Canada to describe an IPC system, including precautions, to reduce the risk of transmission of organisms in healthcare.

Sterilization: The sterilization process results in the destruction of all forms of microbial life including bacteria, viruses, spores and fungi.

Surveillance: The ongoing systematic collection, analysis, and interpretation of healthcare data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those contributing data or to other interested groups who need to know.

Zoonotic diseases: Zoonotic diseases are caused by viruses, bacteria, parasites and fungi that are transmitted from animals and insects to humans and can cause human disease.

Appendix 1

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Appendix 2

Public Health Agency of Canada – Material Safety Data Sheets

Appendix 2 – Public Health Agency of Canada – Material Safety Data Sheets

These Material Safety Data Sheets have been produced by Health Canada and are all currently under revision. They are included here to provide additional information about each agent, and are not required on the worksite by WHMIS legislation. The complete set of MSDSs for biological agents can be found at: **http://www.phac-aspc.gc.ca/msds-ftss/**

Human Immunodeficiency Virus – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Human Immunodeficiency Virus*

SYNONYM OR CROSS REFERENCE: HIV, AIDS, Acquired Immune Deficiency Syndrome, HTLV III LAV

CHARACTERISTICS: Retroviridae (Lentivirus); ss RNA, enveloped icosahedral nucleocapsid, glycoprotein envelope, reverse transcriptase

SECTION II - HEALTH HAZARD

PATHOGENICITY: Insidious onset with non-specific symptoms such as lymphadenopathy, anorexia, chronic diarrhea, weight loss, fever, and fatigue; opportunistic infections and malignant diseases without a known cause for immune deficiency

EPIDEMIOLOGY: First reported in 1981; cases recorded in Americas, Europe, Africa and many other areas; patient categories – homosexually or bisexually active men, drug abusers, Haitian/African emigrants, hemophiliacs, sexual partners of men and women in these categories, infants born to parents in this category

HOST RANGE: Humans

INFECTIOUS DOSE: Unknown

MODE OF TRANSMISSION: Transmitted from person to person through direct exposure to infected body fluids (blood, semen) sexual contact, sharing unclean needles etc.; transplacental transfer can occur

INCUBATION PERIOD: Epidemiologic evidence suggests that duration from exposure to onset of symptoms has a minimum range from 6 months to more than 7 years

SECTION III - DISSEMINATION

COMMUNICABILITY: Period of communicability extends from asymptomatic period through appearance of opportunistic diseases

RESERVOIR: Humans

ZOONOSIS: None

VECTORS: None

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: Several reverse transscriptase and protease inhibitors now licensed

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to many disinfectants - 1% sodium hypochlorite, 2% glutaraldehyde, formaldehyde, ethanol

PHYSICAL INACTIVATION: Effectiveness of 56°C - 60°C heat in destroying HIV in serum not certain, however, heating small volumes of serum for 30 min at 56°C before serologic testing reduces residual infectivity to below detectable levels

SURVIVAL OUTSIDE HOST: Drying in environment causes rapid (within several hours) 90-99% reduction in HIV concentration

SECTION V - MEDICAL

SURVEILLANCE: Serological monitoring for evidence of HIV infection

FIRST AID/TREATMENT: Specific measures for the opportunistic diseases that result from AIDS; "Cocktail" multidrug treatment for HIV

IMMUNIZATION: None available

PROPHYLAXIS: Experimental prophylaxis with AZT/DDI or other appropriate drug

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: 5 reported laboratory acquired infections with HIV (splashing of infected materials, inapparent skin exposure, puncture wounds); 18 reported cases in health care workers worldwide

SOURCES/SPECIMENS: Blood, semen, vaginal secretions, CSF, other specimens containing visible blood, unscreened or inadequately treated blood products

PRIMARY HAZARDS: Direct contact with skin and mucous membranes of the eye, nose and mouth; accidental parenteral inoculation; ingestion; hazard of aerosols exposure unknown

SPECIAL HAZARDS: Extreme care must be taken to avoid spilling and splashing infected materials - virus should be presumed in/on all equipment and devices coming in direct contact with infected materials

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 2 practices, containment equipment and facilities for activities involving clinical specimens and non-cultured procedures (primary containment devices may be indicated eg. biological safety cabinets) and for activities involving non-human primates and any animals experimentally infected or inoculated with HIV; Biosafety level 3 practices, containment equipment and facilities for all work culturing HIV

PROTECTIVE CLOTHING: Gloves should be worn when handling potentially infectious specimens, cultures or tissues; laboratory coats, gowns or suitable protective clothing should be worn

OTHER PRECAUTIONS: Keep hands away from the eyes, nose and mouth in order to avoid potential exposure of the mucous membranes; eye goggles or face shields may assist in accomplishing this objective

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wearing protective clothing, gently cover spill with paper towels and apply 1% sodium hypochlorite, starting at perimeter and working towards the centre; allow sufficient contact time (30 min) before clean up

DISPOSAL: Decontaminate before disposal - steam sterilization, incineration, chemical disinfection

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: September 1996

Prepared by: Office of Biosafety

LCDC

Although the information, opinions and recommendations contained in this Material Safety Data Sheet are compiled from sources believed to be reliable, we accept no responsibility for the accuracy, sufficiency, or reliability or for any loss or injury resulting from the use of the information. Newly discovered hazards are frequent and this information may not be completely up to date.

Hepatitis B virus – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Hepatitis B virus*

SYNONYM OR CROSS REFERENCE: Serum hepatitis, type B hepatitis, homologous serum jaundice, Australia antigen hepatitis, HBV, viral hepatitis B, HB

CHARACTERISTICS: Partially double-stranded DNA, 42-47 nm diameter, enveloped, Hepadnaviridae; lipoprotein coat contains the HBsAg

SECTION II - HEALTH HAZARD

PATHOGENICITY: Two major forms: asymptomatic infection and symptomatic hepatitis; onset is insidious with anorexia, vague abdominal discomfort, nausea and vomiting, sometimes arthralgias and rash, often progressing to jaundice; fever may be absent or mild; severity ranges from inapparent cases to fatal acute hepatic necrosis, or becomes chronically infected; low short term case fatality rate in hospitalized patients; long term case fatality rate is 2-3% due to cancer or cirrhosis of the liver; 95% of adult infections are self limited

EPIDEMIOLOGY: Worldwide; endemic with little seasonal variation; commonly in young adults in North America and in infancy or childhood in Africa and Asia; antigen carrier rate in North America is under 1% for the general population and 10-15% in Asia; common in high risk groups - drug abusers, persons in the health care field exposed to blood or serous fluids, sexually promiscuous individuals

HOST RANGE: Humans (chimpanzees are susceptible)

INFECTIOUS DOSE: Not known, however, 1 mL of infected blood may contain from 102-109 HBV particles

MODE OF TRANSMISSION: Percutaneous or permucosal exposure to infectious body fluids (blood, blood products, cerebral spinal fluid, serum-derived fluids, saliva, semen, vaginal fluids, unfixed tissues and organs), indirect contact with contaminated items in the laboratory; commonly spread by contaminated needles, syringes and other IV equipment; contamination of wounds or lacerations; exposure of mucous membranes; sexual contact, household contact, perinatal transmission from mother to infant, nosocomial exposure

INCUBATION PERIOD: Usually 24-180 days; average 60-90 days; HBsAg can appear in 2 weeks or rarely, 6-9 months, depending on dose, mode of transmission and host factors

COMMUNICABILITY: Blood can be infective weeks before onset of symptoms; remains infective through clinical and chronic carrier states; infectivity of chronically infected individuals varies from highly infectious to sparingly infectious; sera of infected individuals may contain as many as 1010 infectious virons per mL

SECTION III - DISSEMINATION

RESERVOIR: Humans, chimpanzees are susceptible, but an animal reservoir in nature has not been recognized

ZOONOSIS: None

VECTORS: None

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: No specific antivirals

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to many disinfectants; 1% sodium hypochlorite, 70% ethanol, 2% alkalinized glutaraldehyde, formaldehyde

PHYSICAL INACTIVATION: Stable at 37°C for 60 minutes and 56° C for 30 minutes but not at temperatures above 60°C; stable at pH 2.4 for up to 6 hours (some infectivity is lost); HBsAg not destroyed by UV of blood products; stable for years at -70°C

SURVIVAL OUTSIDE HOST: Survives in dried blood for long periods (weeks), stable on environmental surfaces for a least 7 days at 25° C

SECTION V - MEDICAL

SURVEILLANCE: Testing of blood samples for the presence of HBsAg, EIA, RIA, PCR

FIRST AID/TREATMENT: Alpha interferon licensed for treatment of chronic infection. About 30% effective in elimination of "e" antigenemia; Lavivudine (reverse transcriptase inhibitor) is being investigated for chronic infections

IMMUNIZATION: Inactivated vaccine is available and recommended for those of increased risk such as laboratory workers and other health care workers exposed to blood

PROPHYLAXIS: Hepatitis B immunoglobulin (HBIG)

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: The most frequently occurring laboratory-associated infection; incidence in some categories of laboratory workers is 7 times greater that of the general population; 234 reported cases up to 1974 with one death (3921 total infections surveyed); 26 reported cases in UK laboratories from 1980-1987

SOURCES/SPECIMENS: Blood and blood products, urine, semen, CSF, and saliva

PRIMARY HAZARDS: Parenteral inoculation; droplet exposure of mucous membranes; contact exposure of broken skin

SPECIAL HAZARDS: Needle stick with infected blood

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 2 practices and containment for activities utilizing infectious body fluids and tissues; biosafety level 3 primary containment and personnel precautions for activities with high potential for droplet or aerosol production and high production quantities or concentrations; animal biosafety level 2 for work with non-human primates

PROTECTIVE CLOTHING: Laboratory coat; gloves when skin contact is unavoidable and when working with animals; wrap-around gown and gloves for work in biosafety cabinet

OTHER PRECAUTIONS: General needle safety precautions important - do not bend, break or recap needles; dispose directly into puncture-proof container, universal precaution for blood, blood products or specimens containing or contaminated with blood

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wearing protective clothing, gently cover spill with absorbent paper towel and apply 1% sodium hypochlorite, starting at perimeter and working towards the centre; allow sufficient contact time (30 min) before clean up

DISPOSAL: Decontaminate before disposal; steam sterilization, chemical disinfection, incineration

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: May, 2001

Prepared by: Office of Laboratory Security, PHAC

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Hepatitis C virus – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Hepatitis C virus*

SYNONYM OR CROSS REFERENCE: Parenterally transmitted non-A, non-B hepatitis, Non-B transfusion-associated hepatitis, Post-transfusion non-A, non-B hepatitis (PT-NANB), HCV

CHARACTERISTICS: Single stranded, small, positive sense RNA, enveloped, 50 nm diameter, Flaviviridae

SECTION II - HEALTH HAZARD

PATHOGENICITY: Onset is insidious, with anorexia, vague abdominal discomfort, nausea and vomiting, progressing to jaundice (less frequently than hepatitis B); severity ranges from unapparent cases in approximately 90% of infections to rare fulminating, fatal cases; chronic liver disease with fluctuating or persistently elevated liver enzymes is common, occurring after 50%-80% of HCV infections in adults; of those with chronic liver disease, 30%-60% may develop chronic active hepatitis and 5%-20% may develop cirrhosis; chronic infection is often not symptomatic; there appears to be an association between HCV infection and hepatocellular carcinoma, of these chronically infected persons, approximately 50% will develop cirrhosis or cancer of the liver

EPIDEMIOLOGY: HCV has been found in every part of the world where it has been sought; the virus is parenterally transmitted; in the United States, HCV accounts for about 20% of acute viral hepatitis cases, of which less than 5% are associated with blood transfusion; prevalence of anti-HCV is highest in injecting drug users and hemophilia patients (70%-90%), moderate in hemodialysis patients (10%-20%), low in heterosexuals with multiple sex partners, homosexual men, health care workers and family contacts of HCV-infected persons (1%-5%), and lowest in volunteer blood donors (0.3%-0.5%); major cause of parenterally transmitted non A, non B hepatitis

HOST RANGE: Humans; has been experimentally transmitted to chimpanzees

INFECTIOUS DOSE: Not known

MODE OF TRANSMISSION: Percutaneous exposure to contaminated blood (102 - 103 infectious particles / mL of blood) and plasma derivatives; contaminated needles and syringes are important vehicles of spread, especially among injecting drug users; risk of HCV transmission by household contact and sexual activity has not been well defined, but efficiency of transmission via these routes appears to be low; vertical transmission appears to be uncommon, however risk of transmission may increase when the mother is co-infected with HIV; in over 40% of cases, the risk factor(s) for HCV transmission cannot be identified

INCUBATION PERIOD: Ranges from 2 weeks to 6 months; most commonly 7 - 10 weeks; chronic infection may persist for up to 20 years before onset of cirrhosis or heptoma

COMMUNICABILITY: From one or more weeks before onset of first symptoms; may persist in most persons indefinitely

SECTION III - DISSEMINATION

RESERVOIR: Humans. Other reservoirs are unknown in the current literature

ZOONOSIS: Not known

VECTORS: Not known

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: No specific antivirals

SUSCEPTIBILITY TO DISINFECTANTS: The data available in the current literature on the susceptibility of HCV to disinfectants are limited. Therefore, because HCV is an enveloped virus, general disinfection measures against hepatitis B virus are applicable to HCV (1% sodium hypochlorite, 70% ethanol, 2% glutaraldehyde, formaldehyde)

PHYSICAL INACTIVATION: The data available in the current literature on the susceptibility of HCV to physical inactivation are limited. Again, because HCV is an enveloped virus, general inactivation measures against hepatitis B virus are applicable to HCV (stable at 37°C for 60 min but not at temperatures above 60°C; stable at pH 2.4 for up to 6 hours). May not be inactivated by UV

SURVIVAL OUTSIDE HOST: Not known. Suspected to be similar to hepatitis B virus (survives in dried blood for long periods-weeks)

SECTION V - MEDICAL

SURVEILLANCE: Testing of blood samples for elevated liver enzyme levels, anti-HCV or direct viral RNA detection by PCR amplification

FIRST AID/TREATMENT: Interferon alpha has been shown to have an overall beneficial effect in about 25% of chronic hepatitis cases; a combined treatment of ribavirin-interferon alpha has been reported to be equally effective or better than alpha interferon alone for treatment of chronic hepatitis

IMMUNIZATION: Applicability of immunization not known; repeated infections with HCV have been demonstrated in an experimental chimpanzee model

PROPHYLAXIS: None available

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: Medical personnel have slightly higher antibody prevalence to HCV than the general population; therefore health care workers handling blood are at higher risk to HCV infection, however, not to the same degree as HBV infection

SOURCES/SPECIMENS: Blood and blood products. Transmission through sexual and casual contact is not well documented

PRIMARY HAZARDS: Parenteral inoculation of blood and plasma products. However, over half of HCV infections in the United States are due to factors other than percutaneous exposure to HCV. These other factors are yet unknown

SPECIAL HAZARDS: Needle stick with infected blood

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Containment level 2 practices for activities utilizing infectious body fluids and tissues; Containment level 3 and personnel precautions for activities with high potential for droplet or aerosol production and high production quantities or concentrations; Animal Pathogen containment level 2 for work with non-human primates

PROTECTIVE CLOTHING: Laboratory coat; gloves when skin contact is unavoidable and when working with animals; wrap-around gown and gloves for work in biosafety cabinet

OTHER PRECAUTIONS: General needle safety precautions important - do not bend, break or recap needles; dispose directly into puncture-proof container; universal precautions for blood

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wearing protective clothing, gently cover spill with absorbent paper towel and apply 1% sodium hypochlorite (effective for HBV), starting at perimeter and working towards the centre; allow sufficient contact time (30 min-effective for HBV) before clean-up

DISPOSAL: Decontaminate before disposal; steam sterilization, chemical disinfection, incineration

STORAGE: In sealed containers that are properly labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: June, 2001

Prepared by: Office of Laboratory Security, PHAC

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Clostridium difficile – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Clostridium difficile*

SYNONYM OR CROSS REFERENCE: N/A

CHARACTERISTICS: Gram positive rod, anaerobic, motile, subterminal spores, produces a cytotoxin and enterotoxin

SECTION II - HEALTH HAZARD

PATHOGENICITY: Opportunistic pathogen, broad-spectrum antibiotic therapy eliminates competing gut flora, allowing the overgrowth of C. difficile; important cause of antibiotic-associated diarrhea and pseudomembranous colitis; diarrhea in cancer patients receiving chemotherapy; symptoms range from mild diarrhea to severe colitis (possibly fatal)

EPIDEMIOLOGY: Worldwide; 2-3% of adults are asymptomatic carriers ; 50% of healthy neonates (<1 year old) are carriers; nosocomial transmission increasingly important

HOST RANGE: Humans and other animals

INFECTIOUS DOSE: Not known

MODE OF TRANSMISSION: Fecal-oral contact; evidence for transmission via fomites and hands exists

INCUBATION PERIOD: Not known

COMMUNICABILITY: May be transmitted from person to person

SECTION III - DISSEMINATION

RESERVOIR: Soil, water, hay, sand; intestinal tract of humans and other animals

ZOONOSIS: None

VECTORS: None

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: Susceptible to metronidazole and vancomycin

DRUG RESISTANCE: Metronidazole and vancomycin-resistant strains have been reported

SUSCEPTIBILITY TO DISINFECTANTS: Spores are fairly resistant; moderate susceptibility to 1% sodium hypochlorite; susceptible to high level disinfectants (>2% glutaraldehyde) with prolonged contact time

PHYSICAL INACTIVATION: Spores are fairly resistant to heat (spores destroyed by moist heat - 121°C for at least 15 min)

SURVIVAL OUTSIDE HOST: Spores can survive for long periods outside of host

SECTION V - MEDICAL

SURVEILLANCE: Monitor for symptoms; recovery of C. difficile organisms and/or toxin from stool samples

FIRST AID/TREATMENT: Antibiotic therapy should be stopped; oral therapy with metronidazole or vancomycin

IMMUNIZATION: None

PROPHYLAXIS: None

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: 1 reported case of a laboratory-acquired infection from C. difficile

SOURCES/SPECIMENS: Clinical specimens - feces

PRIMARY HAZARDS: Injuries from contaminated sharp instruments

SPECIAL HAZARDS: Not known

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 2 practices, containment equipment and facilities for activities involving clinical specimens and cultures

PROTECTIVE CLOTHING: Laboratory coat; gloves when direct contact with infectious materials is unavoidable

OTHER PRECAUTIONS: None

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wear protective clothing; gently cover spill with paper towels and apply a suitable disinfectant (high level or 1% sodium hypochlorite), starting at perimeter and working towards the centre; allow sufficient contact time before clean up

DISPOSAL: Decontaminate before disposal; steam sterilization, chemical disinfection, incineration

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: January 2000

Prepared by: Office of Laboratory Security, PHAC

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Norwalk virus – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Norwalk virus*

SYNONYM OR CROSS REFERENCE: Acute viral gastroenteritis, Norwalk-like disease, epidemic viral gastroenteritis, acute infectious nonbacterial gasteroenteritis, viral diarrhea, epidemic diarrhea and vomiting, winter vomiting disease, epidemic nausea and vomiting

CHARACTERISTICS: Caliciviridae; round, non-enveloped, 27-32 nm virion; single-stranded positive - sense RNA

SECTION II - HEALTH HAZARD

PATHOGENICITY: Abrupt onset of diarrhea, vomiting, non-bloody diarrhea and abdominal cramps; 25-50% of affected persons report myalgias, malaise, headache, nausea and low-grade fever; illness usually resolves within 24-48 hours; fatality is associated with electrolyte imbalance; symptoms can persist for up to several weeks; higher risk of symptomatic infection in individuals with preexisting levels of antigen-specific antibodies have been documented

EPIDEMIOLOGY: Worldwide and common; affects mainly older children and adults; frequent outbreaks in camps, schools, nursing homes, cruise ships and areas with contaminated drinking and swimming water; outbreaks are limited to 1-2 weeks

HOST RANGE: Humans

INFECTIOUS DOSE: Not known

MODE OF TRANSMISSION: Principally by fecal-oral route; other documented sources include water, food (particularly shellfish and salads), aerosol and fomites

INCUBATION PERIOD: From 10-60 hours; usually 24-48 hours

COMMUNICABILITY: Communicable during the acute stage of the disease; up to 48 hours after resolution of symptoms; presymptomatic shedding has been implicated in epidemiological studies

SECTION III - DISSEMINATION

RESERVOIR: Humans

ZOONOSIS: None

VECTORS: None

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: No specific antivirals

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to 1% sodium hypochlorite, 2% glutaraldehyde

PHYSICAL INACTIVATION: Resistant to pH5-10, ether, acid; survives at 60° C for 30 minutes

SURVIVAL OUTSIDE HOST: Stability unknown; found in contaminated water supplies, lakes

SECTION V - MEDICAL

SURVEILLANCE: Monitor for symptoms; confirm by RIA; conclusive diagnosis by EM examination of stool samples

FIRST AID/TREATMENT: No specific therapy other than electrolyte and fluid replacement

IMMUNIZATION: None available

PROPHYLAXIS: None available

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: None reported to date

SOURCES/SPECIMENS: Stool specimens

PRIMARY HAZARDS: Ingestion; exposure of the mucous membranes to infective aerosols

SPECIAL HAZARDS: None

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 2 practices and containment equipment for all activities involving the virus or any infectious or potentially infectious body fluids or tissues

PROTECTIVE CLOTHING: Laboratory coat; gloves when skin contact with infectious materials is unavoidable

OTHER PRECAUTIONS: None

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wearing protective clothing gently cover the spill with absorbent paper towel and apply 1% sodium hypochlorite starting at the perimeter and working towards the centre; allow sufficient contact time (30 min) before clean up

DISPOSAL: Decontaminate all wastes before disposal; steam sterilization, chemical disinfection, incineration

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: March, 2001

Prepared by: Office of Laboratory Security, PHAC

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Salmonella typhi – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Salmonella typhi*

SYNONYM OR CROSS REFERENCE: Typhoid fever, Enteric fever, Typhus abdominalis, Salmonella choleraesuis serotype typhi, Salmonella enterica serotype typhi

CHARACTERISTICS: Family Enterobacteriaceae; Gram negative rod; motile, aerobic and facultatively anaerobic; serological identification of somatic, flagellar and Vi antigens

SECTION II - HEALTH HAZARD

PATHOGENICITY: Generalized systemic enteric fever, headache, malaise, anorexia, enlarged spleen, and constipation followed by more severe abdominal symptoms; rose spots on trunk in 25% of Caucasian patients; complications include ulceration of Peyer's patches in ileum, can produce hemorrhage or perforation; Common enterocolitis may result without enteric fever; characterized by headache, abdominal pain, nausea, vomiting, diarrhea, dehydration may result; case fatality of 16% reduced to 1% with antibiotic therapy; mild and atypical infections occur

EPIDEMIOLOGY: Worldwide; sporadic cases in North America; most cases represent importation from endemic areas; multi-drug resistant strains have appeared in several areas of world

HOST RANGE: Humans

INFECTIOUS DOSE: 100,000 organisms - ingestion; variable with gastric acidity and size of inoculum

MODE OF TRANSMISSION: Person-to-person; by contaminated food or water; by food contaminated by hands of carriers; flies can infect foods in which the organisms may multiply to achieve an infective dose

INCUBATION PERIOD: Depends on size of infecting dose; usually 1-3 weeks

COMMUNICABILITY: Communicable as long as typhoid bacilli appear in excreta; usually 1st week throughout convalescence; 10% of patients discharge bacilli for 3 months after onset; 2-5% become chronic carriers, may shed bacteria for years

SECTION III - DISSEMINATION

RESERVOIR: Humans - patients with acute illness and chronic carriers

ZOONOSIS: None

VECTORS: Possibly flies (mechanical only)

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: Susceptible to chloramphenicol, ampicillin, amoxicillin, TMP-SMX, fluoroquinolones; Multi-drug resistant (MDR) strains are on the rise; drug susceptibility testing is required

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to many disinfectants - 1% sodium hypochlorite, 70% ethanol, 2% glutaraldehyde, iodines, phenolics, formaldehyde

PHYSICAL INACTIVATION: Sensitive to moist heat (121° C for at least 15 min) and dry heat (160-170° C for at least 1 hour)

SURVIVAL OUTSIDE HOST: Ashes - 130 days; rabbit carcass - 17 days; dust - up to 30 days; feces - up to 62 days; linoleum floor - 10 hours; ice - 240 days; skin - 10-20 min

SECTION V - MEDICAL

SURVEILLANCE: Monitor for symptoms; bacteriological examination of blood, excreta; serology not effective

FIRST AID/TREATMENT: Antibiotic therapy for enteric fever; determine appropriate antibiotic with drug susceptibility testing

IMMUNIZATION: Two typhoid vaccines licensed in Canada, one injectable one oral; vaccine administered for occupational exposure or travel to endemic areas for greater than 4 weeks; does not offer complete protection, immunity may be overwhelmed by large inoculum; oral vaccine is contraindicated in immunocompromised and pregnant individuals

PROPHYLAXIS: Antibiotic prophylaxis

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: Typhoid is the second most commonly reported laboratory infection; at least 256 reported cases with 20 deaths

SOURCES/SPECIMENS: Feces, urine, bile, blood

PRIMARY HAZARDS: Ingestion, parenteral inoculation; importance of aerosol exposure not known

SPECIAL HAZARDS: None

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 2 practices, containment equipment, and facilities for all activities utilizing known or potentially infectious clinical materials and cultures

PROTECTIVE CLOTHING: Laboratory coat; gloves when contact with infected materials is unavoidable

OTHER PRECAUTIONS: Good personal hygiene and frequent hand washing; vaccination for those regularly working with S. typhi cultures or clinical materials

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wearing protective clothing; gently cover spill with paper towels and apply 1% sodium hypochlorite, starting at perimeter and working towards the centre; allow sufficient contact time (30 min) before clean up

DISPOSAL: Decontaminate before disposal; steam sterilization, chemical disinfection

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: March, 2001

Prepared by: Office of Laboratory Security, PHAC

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Staphylococcus aureus – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Staphylococcus aureus*

SYNONYM OR CROSS REFERENCE: Staphylococcal diseases, impetigo, toxic shock syndrome, food poisoning, intoxication

CHARACTERISTICS: Gram positive cocci, usually in clusters; coagulase positive; non-spore forming; non-motile; many strains produce exotoxins including staphylococcal enterotoxins A,B,C,D,E, toxic shock syndrome toxin (TSST-1) and exfoliative toxins A, and B

SECTION II - HEALTH HAZARD

PATHOGENICITY: Opportunistic pathogen, normal flora; produces a variety of syndromes with a range of clinical manifestations; clinically different in general community, newborns, menstruating women, and hospitalized patients; food intoxication is characterized by abrupt/violent onset, severe nausea, cramps, vomiting, and diarrhea using lasting 1-2days; animal bites can result in localized infections; may cause surface or deep/system infections in both community and hospital settings; surface infections include impetigo, folliculitis, abscesses, boils, infected lacerations; deep infections include endocarditis, meningitis, septic arthritis, pneumonia, osteomyelitis; systemic infection may cause fever, headache malaise, myalgia; newborns are susceptible to scalded skin syndrome (SSS) caused by exfoliative toxins; my be colonized during delivery resulting in sepsis meningitis; toxic shock syndrome is an acute multi-system illness caused by TSST-1 a super antigen; characterized by sudden onset, high fever, vomiting, profuse watery diarrhea, myalgia, hypotension erythematous rash

EPIDEMIOLOGY: Occurs worldwide; particularly in areas where personal hygiene is suboptimal; in hospitals by development of antibiotic-resistant strains

HOST RANGE: Humans; to a lesser extent, warm-blooded animals

INFECTIOUS DOSE: Virulence of strains varies greatly

MODE OF TRANSMISSION: Contact with nasal carriers (30-40% of population); from draining lesions or purulent discharges; spread person-to-person; ingestion of food containing staphylococcal enterotoxin (food may be contaminated by food handlers hands); from mother to neonate during delivery

INCUBATION PERIOD: Variable and indefinite, commonly 4-10 days; disease may not occur until several months after colonization; interval between eating food and onset of symptoms is usually 2-4 hours (30 min to 8 hours)

COMMUNICABILITY: As long as purulent lesions continue to drain or carrier state persists; auto-infection may continue for the period of nasal colonization or duration of active lesions

SECTION III - DISSEMINATION

RESERVOIR: Human; patients with indwelling catheters or IVs act as reservoirs for nosocomial infections; food borne - occasionally cows with infected udders

ZOONOSIS: Yes - direct or indirect contact with infected animals

VECTORS: None

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: Many strains are multi-resistant to antibiotics and are of increasing importance; methicillin resistant (MRSA) strains have caused major outbreaks world-wide; Vancomycin resistant (VRSA) are being increasingly isolated; sensitivity must be determined for each strain

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to many disinfectants - 1% sodium hypochlorite, iodine/alcohol solutions, glutaraldehyde, formaldehyde

PHYSICAL INACTIVATION: Organisms are destroyed by heat (moist heat - 121° C for at least 15 min, dry heat - 160-170° C for at least 1 hour; enterotoxins are heat resistant, stable at boiling temperature

SURVIVAL OUTSIDE HOST: Carcass and organs - up to 42 days; floor - less than 7 days; glass - 46 hours; sunlight - 17 hours; UV - 7 hours; meat products - 60 days; coins - up to 7 days; skin from 30 min to 38 days

SECTION V - MEDICAL

SURVEILLANCE: Monitor for skin inflammation if wounded by a sharp instrument; isolation of organism from wound or blood, CSF, urine; isolation of $>10^5$ organisms or enterotoxin from suspected food

FIRST AID/TREATMENT: Fluid replacement for food poisoning; in localized skin infections, drain abscesses; antibiotic therapy for severe infections

IMMUNIZATION: None

PROPHYLAXIS: None

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: 29 reported cases up to 1973 with 1 death

SOURCES/SPECIMENS: Clinical specimens - blood, abcesses, lesion exudates, CSF, respiratory specimens, feces, urine

PRIMARY HAZARDS: Injuries from contaminated sharp instruments; ingestion; aerosols

SPECIAL HAZARDS: Direct contact with open cuts and lesions of skin

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 2 practices, containment equipment and facilities for activities with cultures or potentially infectious clinical materials

PROTECTIVE CLOTHING: Laboratory coat; gloves when skin contact is unavoidable

OTHER PRECAUTIONS: Thorough handwashing before leaving the laboratory and after handling infectious materials

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wear protective clothing; gently cover spill with paper towel and apply 1% sodium hypochlorite, starting at perimeter and working towards the centre; allow sufficient contact time (30 min) before clean up

DISPOSAL: Decontaminate before disposal; steam sterilization, chemical disinfection

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: March, 2001

Prepared by: Office of Laboratory Security, PHAC

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Neisseria meningitidis – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Neisseria meningitidis*

SYNONYM OR CROSS REFERENCE: Meningococcal meningitis, Meningococcal infection, cerebrospinal fever, meningococcemia

CHARACTERISTICS: Gram negative diplococci, intra or extra-cellular; multiple serogroups - 13 recognized groups (Groups A, B, C, X, Y, Z and W135 are frequently occurring); infection of the CSF

SECTION II - HEALTH HAZARD

PATHOGENICITY: Acute disease characterized by sudden onset with fever, intense headache, nausea and often vomiting, stiff neck, and frequently a petechial rash with pink macules; delirium and coma; early diagnosis and modern therapy have reduced case fatality rate from 50% to less than 10%; may be asymptomatic or with only local symptoms, 10% of patients who recover have permanent neurologic disability, limb loss, and hearing loss; invasive with septicemia or meningitis; death rate is high in fulminating meningococcemia; infection usually causes sub-clinical mucosal infections; carrier prevalence of 25% or greater may exist without cases of meningitis

EPIDEMIOLOGY: Worldwide; sporadic cases in both urban and rural areas; greatest incidence in winter and spring; epidemic waves at irregular intervals; primarily a disease of very small children; occurs commonly in children and young adults, in males more than females; more commonly in newly aggregated adults under crowded living conditions; high incidence in sub-Sahara; Group A, B, C mainly responsible; largest epidemic in 1996 reported in West Africa

HOST RANGE: Humans

INFECTIOUS DOSE: Not known

MODE OF TRANSMISSION: By direct contact, including droplets and discharges from nose and throat of infected persons, more often carriers than cases; invasion sufficient to cause systemic disease is comparatively rare; carrier prevalence of 25%; indirect contact not significant

INCUBATION PERIOD: From 2-10 days, commonly 3-4 days

COMMUNICABILITY: Communicable until meningococci are no longer present in discharges; meningococci usually disappear within 24 hours of institution on sulfonamide treatment; penicillin will usually only suppress the organisms but they are not eradicated with this drug

SECTION III - DISSEMINATION

RESERVOIR: Humans

ZOONOSIS: None

VECTORS: None

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: Prophylactic antibiotic of choice is rifampin; ceftraixone, ciprofloxacin are reported to be effective; susceptible to penicillin

DRUG RESISTANCE: Resistance to penicillin, sulfonamides and chloramphenicol have been reported

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to many disinfectants - 1% sodium hypochlorite, 70% ethanol, iodines, glutaraldehyde, formaldehyde

PHYSICAL INACTIVATION: Susceptible to temperature changes and desiccation; inactivated by moist heat (121° C for at least 15 min) and dry heat (160-170° C for at least 1 hour)

SURVIVAL OUTSIDE HOST: Does not survive well in environment

SECTION V - MEDICAL

SURVEILLANCE: Close surveillance for early signs of illness, especially fever; demonstration of organisms in CSF; serological studies

FIRST AID/TREATMENT: Initiate antibiotic treatment immediately when the presumptive clinical diagnosis is made

IMMUNIZATION: Personnel working with high concentrations or large quantities of organisms should be immunized with the tetravalent polysaccharide vaccine (A, C, Y, and W-135); a bivalent vaccine (A and C)

PROPHYLAXIS: Rifampin for close contacts or if have intimate exposure to nasopharyngeal secretions; sulfonamides may be used if less than 5% of strains from cases are resistant

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: Demonstrated hazard to laboratory workers; 8 reported cases up to 1974 (Pike, R.M.; Ann Rev Microbiol., 1979; 33:41-46); 2 fatal cases in clinical labs in 1988 (MMWR 1991: 40:46-47); 2 fatal case in 1991 (unpublished)

SOURCES/SPECIMENS: Pharyngeal exudates, cerebrospinal fluid, blood, saliva

PRIMARY HAZARDS: Parenteral inoculation; droplet or aerosol exposure of mucous membranes; infectious aerosols and ingestion

SPECIAL HAZARDS: None

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 2 practices, containment equipment and facilities for all activities utilizing known or potentially infectious body fluids and tissues; additional containment (biosafety level 3) for activities with high potential for aerosol production or activities involving production quantities or concentrations of infectious cultures

PROTECTIVE CLOTHING: Laboratory coat; gloves when working with infectious materials; gloves and gowns with ties in back and tight wrists when working in biosafety cabinet

OTHER PRECAUTIONS: Certified biological safety cabinets should be used when mechanical manipulations that have aerosol potential are performed

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wearing protective clothing, gently cover spill with paper towel and then 1% sodium hypochlorite, starting at perimeter and working towards the centre; allow sufficient contact time (30 min) before clean up

DISPOSAL: Decontaminate before disposal; steam sterilization, chemical disinfection, incineration

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: March, 2001

Prepared by: Office of Laboratory Security, PHAC

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Creutzfeldt-Jakob agent, Kuru agent – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Creutzfeldt-Jakob agent, Kuru agent*

SYNONYM OR CROSS REFERENCE: Subacute spongiform encephalopathy, Creutzfeldt-Jakob disease (CJD), Kuru, Chronic infectious neuropathic agents (CHINA's)

CHARACTERISTICS: Filterable, self-replicating agent, slow infectious pathogen, prion

SECTION II - HEALTH HAZARD

PATHOGENICITY: CJD - insidious onset of confusion, progressive dementia, myoclonic jerks with spasticity, wasting and coma; slight elevation of CSF proteins; death usually occurs in less than 1 year; 10% cases have family history of presenile dementia; amorphous amyloid plaques in cerebellum of 15% of cases; Kuru - CNS disease with cerebellar ataxia, incoordination, tremors, rigidity, progressive wasting and death within 3-9 months

EPIDEMIOLOGY: CJD - Reported from 50 countries with highest incidence found among Libyan Jews in Israel; Kuru - occured in Fore tribe of Papua New Guinea

HOST RANGE: Humans, transmissible to chimpanzees, monkeys, guinea pigs, mice

INFECTIOUS DOSE: Unknown

MODE OF TRANSMISSION: The mode of transmission of most cases is unknown; iatrogenic cases of CJD reported (corneal transplant, from cortical electrodes previously used on known patients, brain or eye surgery, human growth hormone therapy, exposure to infected brain tissues by pathologists), no evidence of transmission of CJD from one person to another: Kuru-handling and eating kuru infected brain during ritualistic cannibalism

INCUBATION PERIOD: Fifteen months to 2 years to CJD iatrogenic cases; 4 to over 20 years for Kuru

COMMUNICABILITY: CNS and other tissues are infectious throughout symptomatic illness; lymphoid and other organs probably infectious before signs of illness appear

SECTION III - DISSEMINATION

RESERVOIR: Human cases constitute the only known reservoir

ZOONOSIS: No documented human infections acquired from animals although this has been hypothesized (consumption of scrapie-infected sheep might result in CJD; in 1996 consumption of BSE-infected beef in UK has been associated with development of CJ-like disease)

VECTORS: None

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: N/A

SUSCEPTIBILITY TO DISINFECTANTS: Resistance to commonly used disinfectants is well recognized: formaldehyde, glutaraldehyde, ethanol, and iodine. Immersion in undiluted bleach (60,000 ppm available chlorine) for 1 hour is only partially effective. Disinfection should be carried out using 1N sodium hydroxide at room temperature for 1 hour (shorter treatments have occasionally not inactivated the pathogen)

PHYSICAL INACTIVATION: Resistant to ultraviolet and ionizing radiation, ultrasonication, nucleases, boiling, heat; autoclaving - 15 to 30 min at 121°C or 132°C will not effectively inactivate pathogen, 1 hour at 132°C is recommended)

SURVIVAL OUTSIDE HOST: Contaminated electrodes stored in ethanol-formalin for several years were found to cause CJD in chimpanzee

SECTION V - MEDICAL

SURVEILLANCE: Monitor for clinical signs - diagnosis based on EEG, histopathological findings, transmission to animals from biopsy specimens

FIRST AID/TREATMENT: Any skin contact with infectious materials should be followed by washing with sodium hydroxide; no specific treatment

IMMUNIZATION: None

PROPHYLAXIS: None

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: No documented laboratory-associated infections with spongiform encephalopathies however, consequences of infection are grave and there are cases of infection from contaminated EEG electrodes and corneal transplants

SOURCES/SPECIMENS: High titres in brain and CNS of persons with Kuru; CJD brain, spleen, liver, lymph nodes, lungs, spinal cord, kidneys, cornea and lens, blood, urine; includes formalin-fixed specimens

PRIMARY HAZARDS: Accidental parenteral inoculation; risk of infection from aerosols, droplets, and exposure of intact skin, gastric and mucous membranes is not known

SPECIAL HAZARDS: Laboratory animals that have been infected and their tissues should be considered potentially hazardous

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 3 facilities, practices and containment equipment for activities involving these agents; also listed under biosafety level 2 with special precautions; level of containment will depend on the nature of the manipulations and the amount of sera, bio/necropsy materials handled

PROTECTIVE CLOTHING: Gown and gloves when handling potentially infectious materials; eye protection may also be indicated

OTHER PRECAUTIONS: Extreme care must be taken to avoid accidental autoinoculation or other parenteral inoculations of infectious tissues and fluids

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow any potential aerosols to settle; wearing protective clothing, gently cover spill with paper towel and apply 1N sodium hydroxide, starting at perimeter and working towards the centre; allow sufficient contact time (1 hour) before clean up

DISPOSAL: Decontaminate before disposal; steam sterilization (132°C for 1 hour), disinfection with 1N sodium hydroxide for 1 hour, incineration

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: September 1996

Prepared by: Office of Biosafety

LCDC

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Streptococcus pyogenes – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Streptococcus pyogenes*

SYNONYM OR CROSS REFERENCE: Group A (Beta hemolytic) streptococci, streptococcal sore throat, scarlet fever, impetigo, erysipelas, puerperal fever, necrotizing facsciitis

CHARACTERISTICS: Gram-positive cocci occurring in pairs or chains, facultatively anaerobic, nonmotile, beta hemolysis on blood agar; 80 serologically distinct types

SECTION II - HEALTH HAZARD

PATHOGENICITY: Cause a variety of diseases; streptococcal sore throat (fever, exudative tonsillitis, pharyngitis), streptococcal skin infections (impetigo or pyoderma - usually superficial), scarlet fever (skin rash, fever, nausea, case fatality rate of 3%), puerperal fever (bacterial invasion of genital tract), septicemia, erysipelas (fever, leukocytosis, red spreading lesion), perianal cellulitis, mastoiditis, otitis media, pneumonia, peritonitis and wound infections; acute glomerulonephritis may result; acute rheumatic fever; toxic shock-like syndrome (hypotension, renal impairment, thrombocytopenia, disseminated intravascular coagulation, bilirubin elevation, adult respiratory distress syndrom, necrotizing fasciitis; necrotizing fasciitis is a serious, often fatal, rare infection of the skin and subcutaneous tissue characterized by swelling, appearance of violet colour, blister formation, fever; serious cases progress rapidly with high mortality

EPIDEMIOLOGY: Common in temperate zones, well recognized in semitropics and less frequently recognized in tropical climates; in North America, may be endemic, epidemic or sporadic; highest incidence during late winter and spring; 3-15 year age group most often affected; impetigo occurs in young children in late summer and fall in hot climates; erysipelas most common after 20 years of age and in infants (sporadic occurrence); *Streptococcus pharyngitis* is unusual under 3 years of age, peaks in age group 6-12

HOST RANGE: Humans

INFECTIOUS DOSE: Not known

MODE OF TRANSMISSION: Large respiratory droplets, direct or intimate contact with patient or carrier (especially nasal); rarely by indirect contact through objects or hands; organisms may be recovered from skin 1-2 weeks before impetigo lesions and same strain appears in throat late in course of skin infection; anal, vaginal, skin and pharyngeal carriers responsible for noscomial outbreaks of wound infections; dried streptococci in dust etc. viable but non-infectious for mucous membranes or intact skin; group A streptococci may be transmitted to cattle from human carriers then spread through raw milk from these cattle; ingestion of contaminated foods (milk products, eggs) may result in explosive outbreaks; necrotizing fasciitis more often begins with skin infection at site of minor wounds or punctures

INCUBATION PERIOD: Short; usually 1-3 days, rarely longer

COMMUNICABILITY: In untreated uncomplicated cases period of communicability is 10-21 days; in untreated conditions with purulent discharges, period may extend to weeks or months; with adequate treatment, transmissibility generally is terminated within 24-48 hours; streptococcal pharyngitis is contagious for 2- 3 weeks if untreated

SECTION III - DISSEMINATION

RESERVOIR: Humans

ZOONOSIS: None

VECTORS: None

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: Sensitive to penicillin (benzathine penicillin G); clindamycin or a cephalosporin can be used when penicillin and erythromycin are contraindicated

DRUG RESISTANCE: Resistant to tetracyclines; macrolide-resistant strains in the increase

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to many disinfectants - 1% sodium hypochlorite, 70% ethanol, glutaraldehyde, formaldehyde, iodines

PHYSICAL INACTIVATION: Sensitive to moist heat (121° C for at least 15 min) and dry heat (160-170° C for at least 1 hour)

SURVIVAL OUTSIDE HOST: Dust - up to 195 days; flies caught in hospital carried organism on their feet; survives in milk at 20 to 37° C; cheese - up to 126 days; pus - up to 110 days; blankets - 120 days; rim of drinking glass - 2 days

SECTION V - MEDICAL

SURVEILLANCE: Monitor for symptoms; confirm by bacteriological and serological testing

FIRST AID/TREATMENT: Antibiotic therapy with penicillin (erythromycin for penicillin-sensitive patients); necrotizing fasciitis - early medical treatment critical (penicillin along with aggressive surgical debridement), limb amputation may be necessary in advanced cases

IMMUNIZATION: None

PROPHYLAXIS: Administer penicillin (long-term prophylaxis with long-acting benzathine penicillin G for persons whom recurrent streptococcal infections constitutes a special risk)

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: 78 recorded cases with 4 deaths up to 1976; 5th most common laboratory acquired infection

SOURCES/SPECIMENS: Respiratory specimens, skin lesions, blood, urine, wound exudates (pus etc.)

PRIMARY HAZARDS: Inhalation of infectious aerosols; accidental parenteral inoculation; ingestion; direct contact of mucous membranes and skin lesions

SPECIAL HAZARDS: None

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 2 practices, containment equipment and facilities for all activities involving known or potentially infected clinical materials or cultures; animal biosafety level 2 facilities for studies utilizing infected animals

PROTECTIVE CLOTHING: Laboratory coat; gloves when contact with infectious materials in unavoidable

OTHER PRECAUTIONS: None

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wearing protective clothing, gently cover spill with absorbent paper towel and apply 1% sodium hypochlorite, starting at perimeter and working towards the centre; allow sufficient contact time (30 min) before clean up

DISPOSAL: Decontaminate before disposal: steam sterilization, chemical disinfection, incineration

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: June, 2001

Prepared by: Office of Laboratory Security, PHAC

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Mycobacterium tuberculosis, Mycobacterium bovis – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Mycobacterium tuberculosis, Mycobacterium bovis*

SYNONYM OR CROSS REFERENCE: TB

CHARACTERISTICS: Gram positive rods, non-spore forming, non-motile, slightly curved, forming strands and cords, acid-fast staining, aerobic, slow-growing.

SECTION II - HEALTH HAZARD

PATHOGENICITY: Initial infection usually unnoticed, tuberculin sensitivity appears in a few weeks and lesions commonly heal; may progress to pulmonary tuberculosis (fatigue, fever, cough, chest pain, hemoptysis fibrosis, cavitation) or extrapulmonary involvement (miliary, meningeal) by lymphohematogenous dissemination; serious outcome of initial infection more frequent in infants and children; infection with bovine bacillus rare; drug resistant strains can cause irreversible damage in the lungs

EPIDEMIOLOGY: Worldwide (important cause of disability and death in many parts of the world despite downward mortality and morbidity rates); higher in males, among poor and in cities; in low incidence areas, most tuberculosis is endogenous (reactivation of initial latent foci); long exposures of some contacts leads to high risk of infection (25-50%); epidemics in enclosed areas; *M. bovis* infection encountered where disease in cattle has not been controlled and raw milk is still used; 11.8% of the isolates are drug resistant, 1.2% being multi-drug resistant

HOST RANGE: Primarily humans, cattle, primates, other animals (rodents)

INFECTIOUS DOSE: 10 bacilli by inhalation

MODE OF TRANSMISSION: Portal entry is the lung; pathogen is carried as airborne particles (droplet nuclei); exposure to airborne bacilli from sputum of infected persons; direct invasion of mucous membranes or breaks in skin; bovine tuberculosis from exposure to infected cattle (airborne, ingestion of raw milk or dairy products); medical personnel at risk while performing autopsies, intubation, bronchoscopies or by dermal innoculation

INCUBATION PERIOD: From infection to primary lesion or significant tuberculin reaction - 4 to 12 weeks; risk of progressive pulmonary or extrapulmonary tuberculosis is greatest within 1 to 2 years after infection; may persist for lifetime as latent infection

COMMUNICABILITY: Communicable as long as bacilli are discharged in sputum (may be years if untreated); extrapulmonary TB (except laryngeal tuberculosis) generally not communicable

SECTION III - DISSEMINATION

RESERVOIR: Primarily humans; in some areas, diseased cattle, badgers, swine and other mammals are infected (M. bovis)

ZOONOSIS: Yes - inhalation of infected droplets; direct contact with infected animals or tissues of infected animals

VECTORS: None

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: Sensitive to combination of antimicrobial drugs - isoniazid, rifampin, streptomycin, ethambutol, pyrazinamide

DRUG RESISTANCE: Isoniazid (INH) and rifampin; multi-drug resistant isolates are resistant to first and second-line antibiotics

SUSCEPTIBILITY TO DISINFECTANTS: Greater resistant to disinfectants and require longer contact times for most disinfectants to be effective; 5% phenol, 1% sodium hypochlorite (only if low organic matter and longer contact times), iodine solutions (high concentration of available iodine required), glutaraldehyde and formaldehyde (longer contact time) are effective

PHYSICAL INACTIVATION: Sensitive to moist heat (121° C for at least 15 min), light

SURVIVAL OUTSIDE HOST: Guinea pig carcasses - 49 days; carpet - up to 70 days; dust - 90 to 120 days; cockroaches - 40 days; manure 45 days; paper book - 105 days; sputum (cool, dark location) - 6 to 8 months; clothing - 45 days

SECTION V - MEDICAL

SURVEILLANCE: Skin testing with PPD (purified protein derivative) of previously skin-tested-negative personnel; chest X-ray

FIRST AID/TREATMENT: Combination antibiotic therapy

IMMUNIZATION: Licensed attenuated live vaccine (BCG) available, but not routinely carried out

PROPHYLAXIS: Preventative treatment with INH (risk of hepatitis for those over 35 years old)

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: Incidence of tuberculosis in laboratory workers working with M. tuberculosis is three times higher than those not working with agent; fourth most commonly reported laboratory infection; 176 reported cases with 4 deaths

SOURCES/SPECIMENS: Sputum, gastric lavage fluids, cereobrospinal fluid, urine, lesions from a variety of tissues

PRIMARY HAZARDS: Inhalation of infectious aerosols; accidental parenteral inoculation, direct contact of mucous membranes, ingestion; naturally or experimentally infected non-human primates are a known cause of human infection; litter of infected animals (e.g. mice and hamsters) serve as source of infectious aerosols;

SPECIAL HAZARDS: Bacilli may survive in heat-fixed smears and may be aerosolized in the preparation of frozen sections and during manipulation of cultures; high rate of isolation of acid fast organisms from clinical specimens (>10%), sputum and other specimens, from suspected or known cases

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 2 practices, containment equipment and facilities for primary culture of sputum and preparing smears; biosafety level 3 practices, containment equipment and facilities for the propagation and manipulation of cultures of *M. tuberculosis* or *M. bovis* and for animal studies utilizing non-human primates

PROTECTIVE CLOTHING: Laboratory coat and gloves when manipulating specimens; gloves and gown with tight wrists and ties in back when manipulating cultures

OTHER PRECAUTIONS: Appropriate practices and precautions to minimize the production of infectious aerosols

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wearing protective clothing, gently cover spill with paper towels and apply 5% phenol, starting at perimeter and working towards the centre; allow sufficient contact time (30 min) before clean up

DISPOSAL: Decontaminate before disposal; steam sterilization, incineration

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: March, 2001

Prepared by: Office of Laboratory Security, PHAC

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Legionella pneumophila – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Legionella pneumophila*

SYNONYM OR CROSS REFERENCE: Legionnaires' disease, Legionellosis, Legionnaires' pneumonia, Pontiac fever

CHARACTERISTICS: Gram-negative rod, poorly stained, aerobic, difficult to grow in vitro, serogroups 1-18

SECTION II - HEALTH HAZARD

PATHOGENICITY: An acute pneumonitis associated with anorexia, malaise, myalgia, headache, fever and chills, nonproductive cough, abdominal pain and diarrhea; case fatality rate of 39-50% in hospitalized cases; Pontiac fever - not associated with pneumonia, recovery within 5 days

EPIDEMIOLOGY: First documented outbreak in 1957 in US; identified in North America, Africa, Australia and Europe; sporadic cases and outbreaks more common in summer and autumn; causes 2-15% of all community-acquired pneumonias requiring hospitalization; legionellosis attack rate - 0.1-5%, Pontiac fever rate -95%

HOST RANGE: Humans; experimental infection in guinea pigs and embryonated chicken eggs; challenged rabbits develop antibodies but not clinical disease; mice are refractory to parenteral exposure

INFECTIOUS DOSE: Not known

MODE OF TRANSMISSION: Epidemiologic evidence supports aerosol transmission; other modes are possible including aspiration of water

INCUBATION PERIOD: Legionnaires' disease - 2-10 days, most often 5-6 days; Pontiac fever - 5-66 hours, most often 24-48 hours

COMMUNICABILITY: Person-to-person transmission has not been documented; animal to animal transmission shown not to occur in a variety of experimentally infected mammalian and avian species

SECTION III - DISSEMINATION

RESERVOIR: Aqueous - hot water systems, air-conditioning cooling towers, evaporative condensers, respiratory therapy devices, hot and cold water taps, showers, creeks, ponds; soil has been suspected

ZOONOSIS: None

VECTORS: None

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: Sensitive to erythromycin and rifampin, ciprofloxacin;

DRUG RSESISTANCE: Resistant to penicillin, cephalosporins, and aminoglycosides

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to many disinfectants - 1% sodium hypochlorite, 70% ethanol, glutaraldehyde, formaldehyde

PHYSICAL INACTIVATION: Susceptible to moist heat (121° C for at least 15 min) and dry heat (160-170° C for at least 1 hour)

SURVIVAL OUTSIDE HOST: Survives for months in tap or distilled water

SECTION V - MEDICAL

SURVEILLANCE: Monitor for symptoms; confirm by isolation of organism for respiratory samples; rise in IFA titre

FIRST AID/TREATMENT: Hypoxic patients should receive oxygen; fluid replacement; antibiotic therapy

IMMUNIZATION: None

PROPHYLAXIS: Antibiotic prophylaxis

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: One documented case due to aerosol exposure during animal challenge studies

SOURCES/SPECIMENS: Pleural fluids, tissue, sputum, environmental sources (cooling tower water)

PRIMARY HAZARDS: Generation of aerosols during the manipulation of culture or other concentrations of infectious materials (eg. infected yolk sacs and tissues)

SPECIAL HAZARDS: When working with respiratory cultures, Francisella tularensis can mimic the growth requirements of Legionella

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 2 practices, containment equipment and facilities for all activities involving the known or potentially infectious clinical materials or cultures and the housing of infected animals

PROTECTIVE CLOTHING: Laboratory coat; gloves when direct contact with infectious materials is unavoidable; gloves and gown for work in biosafety cabinet

OTHER PRECAUTIONS: Primary containment devices and equipment (biological safety cabinets, centrifuge safety cups) should be used for activities likely to generate potentially infectious aerosols

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wear protective clothing; gently cover spill with paper towels and apply 1% sodium hypochlorite, starting at perimeter and working towards the centre; allow sufficient contact time (30 min)

DISPOSAL: Decontaminate before disposal - steam sterilization, chemical disinfection, incineration

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: March, 2001

Prepared by: Office of Laboratory Security, PHAC

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Aspergillus spp. – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Aspergillus spp.*

SYNONYM OR CROSS REFERENCE: Aspergillus fumigatus, A. niger, A. flavus, Aspergillosis, Farmer's lung

CHARACTERISTICS: Rapidly growing mold with septate hyphae and conidia; differentiation on basis of conidiophores and conidia

SECTION II - HEALTH HAZARD

PATHOGENICITY: Variety of forms of infection depending on species involved, i.e. aspergilloma, aspergillosis pneumonia; aspergillosis is characterized by pulmonary infiltrates, eosinophilia and a rise in IgG; immunosuppressed individuals are prone to develop an acute pneumonia with multifocal infiltrates expanding to consolidation; dissemination to other organs (eg. cardiac valve) is common; most common cause of otomycosis; clinical manifestation and severity are largely determined by the general immunologic state of the patient

EPIDEMIOLOGY: Worldwide; uncommon; hospital air and airducts associated with nosocomial outbreaks; high aflatoxin and other mycotoxins produced by A. flavus correlated to heptocellular cancer in Africa and Southeast Asia

HOST RANGE: Humans

INFECTIOUS DOSE: Not known

MODE OF TRANSMISSION: Inhalation of airborne conidia

INCUBATION PERIOD: Variable; few days to weeks

COMMUNICABILITY: Not transmitted from person to person

SECTION III - DISSEMINATION

RESERVOIR: Widely distributed in nature; in soil, cereal grains, hay and other plant material or foodstuff

ZOONOSIS: None

VECTORS: None

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: Susceptible to amphotericin B, itraconazole or voriconazole

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to 1 % sodium hypochlorite, 2% glutaraldehyde; susceptibility to 70% ethanol and phenolics questionable (0.4% chlorine for 2 min has been recommended for surface disinfection of food samples)

PHYSICAL INACTIVATION: Inactivated by heat and irradiation

SURVIVAL OUTSIDE HOST: Spores are very resistant; survive in soil and decaying matter for a long time

SECTION V - MEDICAL

SURVEILLANCE: Monitor for symptoms; confirm microscopically using potassium hydroxide.

FIRST AID/TREATMENT: Administer amphotericin B; reduce immunosuppressive therapy where possible; surgical intervention in unusual "solid" lesion cases

IMMUNIZATION: None available

PROPHYLAXIS: None available

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: None reported to date (many non-laboratory occupationally-acquired infections have been reported)

SOURCES/SPECIMENS: Sputum; soil and environmental samples may contain infectious conidia

PRIMARY HAZARDS: Inhalation of conidia

SPECIAL HAZARDS: None

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 2 practices and containment facilities for activities involving the fungus or infectious body fluids and tissues

PROTECTIVE CLOTHING: Laboratory coat; gloves when skin contact with infectious materials is unavoidable

OTHER PRECAUTIONS: None

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wearing protective clothing gently cover spill with absorbent paper towel and apply 1% sodium hypchlorite starting at the perimeter and working towards the centre; allow sufficient contact time (30 min) before clean up

DISPOSAL: Decontaminate all wastes before disposal; steam sterilization, chemical disinfection, incineration

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: November 1999

Prepared by: Office of Laboratory Security, PHAC

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Bacillus anthracis – MSDS

SECTION I - INFECTIOUS AGENT

NAME: *Bacillus anthracis*

SYNONYM OR CROSS REFERENCE: Anthrax, woolsorters' disease

CHARACTERISTICS: Aerobic, large Gram positive rods occurring in chains; non-motile; forms resistant spores

SECTION II - HEALTH HAZARD

PATHOGENICITY: Cutaneous anthrax - skin lesion becoming papular, then vesiculated and developing into a depressed eschar (5-20% case fatality in untreated cases); inhalation anthrax - respiratory distress, fever and shock with death shortly thereafter; intestinal anthrax - abdominal distress followed by fever, septicemia and death (rare); oropharyngeal form described

EPIDEMIOLOGY: Infrequent and sporadic in most industrial countries; occupational hazard of workers who process hides, hair, wool, bone and bone products; of laboratory workers and of veterinarians and agricultural workers who handle infected animals; endemic in agricultural regions where anthrax in animals is common (Africa, Asia and Middle East)

HOST RANGE: Humans, cattle, sheep, goats, horses, pigs

INFECTIOUS DOSE: 8,000 to 50,000 organisms by inhalation

MODE OF TRANSMISSION: Infection of skin by contact with infected animal tissues and possible by biting flies feeding on such animals, or by contaminated hair, wool, hides or products made from them; inhalation anthrax results from inhalation of spores in contaminated soil areas, dried or processed skins and hides of infected animals; intestinal anthrax from ingestion of contaminated undercooked meat

INCUBATION PERIOD: Within 7 days of exposure, usually 2 to 5

COMMUNICABILITY: Transmission from person to person is very rare

SECTION III - DISSEMINATION

RESERVOIR: Spores are resistant to adverse environmental conditions and remain viable for years in soil, dried or processed hides

ZOONOSIS: Yes - disease spreads among grazing animals through contaminated soil and feed and among omnivorous and carnivorous animals through contaminated meat, bone meal or other feed; vultures have been reported to spread the organism from one area to another

VECTORS: Infection of skin may possibly occur through biting flies which had fed on infected animals

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: Susceptible to penicillin (except for inhalation anthrax in which the mortality remains high); ciprofloxacin, doxycycline, tetracylines, erythromycin, chloramphenicol

SUSCEPTIBILITY TO DISINFECTANTS: Spores are resistant to many disinfectants; susceptible to 2% glutaraldehyde formaldehyde and 5% formalin (overnight soak preferable)

PHYSICAL INACTIVATION: Spores are highly resistant to drying, heat, and sunlight; adequate sterilization requires direct exposure to 121°C for at least 30 min

SURVIVAL OUTSIDE HOST: Spores remain viable in soil, skins and hides of infected animals and contaminated air and wool for decades; survival in milk - 10 years; dried on filter paper - 41 years; dried on silk threads - up to 71 years; pond water - 2 years

SECTION V - MEDICAL

SURVEILLANCE: Monitor for suspicious skin lesions and other symptoms; laboratory confirmation through direct microscopy, culture, immunological techniques

FIRST AID/TREATMENT: Prompt treatment with high-dose antibiotics

IMMUNIZATION: Vaccine available through the Centers for Disease Control and Prevention and is recommended for those workers with frequent exposure to clinical specimens and cultures; vaccination of cattle or other livestock may be justified in anthrax-endemic areas

PROPHYLAXIS: Antibiotic treatment (oral ciprofloxacin or doxycycline)

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: 45 cases with 5 deaths occurring primarily in facilities conducting anthrax research; 25 reported cases of cutaneous anthrax among armed forces personnel

SOURCES/SPECIMENS: Blood, skin lesion exudates, and rarely in urine and faeces; hides, hair, wool, bone and bone products, and tissues from infected animals

PRIMARY HAZARDS: Direct and indirect contact of skin with cultures and contaminated laboratory surfaces; accidental parenteral inoculation; exposure to infectious aerosols

SPECIAL HAZARDS: Naturally and experimentally infected animals pose a risk to laboratory and animal care personnel

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety level 3 practices and facilities are recommended for work with anthrax; Agriculture Canada may also require special conditions for the use or importation of this agent

PROTECTIVE CLOTHING: Use of adequate protective clothing (gloves, gowns with tight wrists and ties in back) and facilities for washing and changing clothes after work

OTHER PRECAUTIONS: Care of skin abrasions and proper handling of potentially contaminated articles is essential

SECTION VIII - HANDLING INFORMATION

SPILLS: Allow aerosols to settle; wearing protective clothing, gently cover spill with paper towels and apply suitable disinfectant (glutaraldehyde, formalin), starting at the perimeter and working towards the centre; allow sufficient contact time before clean up

DISPOSAL: Incineration or steam sterilization of cultures and infected materials; animals that have died from anthrax should be burned or deeply buried and covered with lime

STORAGE: In sealed containers that are appropriately labelled and secured in a level 3 facility

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: November 1999

Prepared by: Office of Laboratory Security, PHAC

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